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EDITORIAL

NATIONAL HIGHWAYS

In a democratic form of government the legislative and executive departments follow the demands of their constituents and seldom or never attempt the control or influencing of the people by the methods used in countries whose forms of government are more or less paternal.

To be sure, much legislation is enacted which has an educational or paternal object more or less clearly indicated, but such laws are passed under the pressure of constituents of the law-makers and do not express any definite theory of the principles of government. Moreover, unless a large majority of the people are favorable to the laws thus pushed thru the legislature, the executive departments, in their turn considering their constituents and their votes, fail to enforce the laws and conditions are worse than if the laws had not been passed, even from the standpoint of education.

It is a common experience among those who are trying to develop some movement for the benefit or the advancement of the public that the need and the value of the project must first be demonstrated thru private initiative and that then, public opinion being aroused in its favor, the governmental body takes it over and thereafter operates and develops it as a public charge.

The projects for the establishment and construction of national highways have been following the line above laid out. Very attractive general systems of national and inter-state highways have been laid out and Congress has been besieged by many organizations and to some extent by the general public with requests and even demands that the National Government assume the construction of such a system. Up to the present time, public opinion in general has not been positively in favor of such an extension of governmental activities and the majority in Congress has really represented the ideas of the majority of the people. The same is true in some states, such as Indiana, where public opinion is not yet favorable to state construction and control of main highways, notwithstanding the successful experience of neighboring and other states where state highway construction has been satisfactory in proportion to the extent of the state control.

Meantime, the National Old Trails road, the Lincoln highway, the National Parks highway, and within a few days the Dixie highway, have been promoted by those most interested in these lines, and their construction is being induced by every means possible. This construction must be irregular in quality and cost because it must be done by the local communities. Numerous other long north-and-south and east-and-west lines, as well as shorter lines, have had their days of prominence and have proved too serious problems for private initiative to solve. All of them, as well as the agitation in Congress and the few laws and appropriations which have found their way thru, have been educative, and ultimately, the promoters of the roads mentioned, and others yet to come up, will demonstrate the value of national lines and a national system sufficiently to influence a majority of the people to consider them favorably, when legislation and appropriations will follow.

Perhaps because of the rivalries stimulated by the promoters between competing lines for the location of the national line, especially in the case of the Dixie highway, the influence of local conditions and of local organizations upon the location of the main line has been fully demonstrated, and will in time form the basis of a strong argument in favor of control of the lines of the system by a national authority, which can be outside and influenced but little by local jealousies and special interests, at the same time that it will take into consideration the demands of local traffic and take care of the national characteristics of the line.

This conflict of local interests has been more pronounced in the case of the Dixie highway than in that of the National Old Trails or the Lincoln highways because the latter follow closely old established continental lines of travel and the location of but little of their lengths could be contested or changed by interests off of those continental lines. Indeed, the great majority of the local as well as national interest is concentrated on those lines.

We may soon look for greater favor for the project of national highways under some form of national control and financing, tho it may be some years before national highway expenditures will vie with river and harbor appropriations.

FINANCING AND BUILDING A COUNTY HIGHWAY

The financing of the construction of a road is a problem of engineering as well as the construction itself, the only difference being that in the first case men are to be brought into proper relations with the improvement and in the other the materials are to be placed where they will do the most good. This article shows the problems arising in a Michigan case, where the conditions are similar to those in many other counties in the state, the public-spirited way in which they were attacked, and the marked success resulting from intelligent, concerted effort on a well considered course of action.

The story of the financing of the road is supplemented by brief descriptions of the methods and apparatus used in building the road, which is now well under way, the first section to be completed this summer.

MICHIGAN has a township system of building roads which has been in operation for many years. Some years ago this system was supplemented by an optional county system. Under the provisions of this law, the county could by vote choose to build roads under a board of county commissioners, who have certain powers of issuing bonds and levying taxes. The state has a system of awards whereby the townships and counties building roads receive state aid in the shape of a certain payment toward the cost of a road, which is proportional to the mileage and also bears a certain relation to the quality of the road, and therefore to a certain extent to its cost per unit of length. The state has set definite amounts per mile which it will pay for each class of road built under the specifications and supervision of its highway department. Applications are made for these awards and they are made as rapidly as the appropriations made by the legislature will permit and the county and township authorities comply with the provisions of the law and the regulations of the state highway department.

In Bloomfield township, southeast of Pontiac, Oakland county, and running up to the village of Birmingham, is a district composed principally of the large estates and country homes of influential and wealthy Detroit business men. Among them is Edwin S. George. The road he travelled between Detroit and his home was a fair sample of a much-used, little-cared-for trunk-line highway. In spots it was tolerably good. In other spots it was rutted and gullied, and in wet weather immeasurably muddy. In the village of Birmingham itself, there was a hilly mile of the worst highway to be found in the county, a spot where stalled autos were the rule rather than the exception in bad weather. The road has one section of improved roadway, representing the enterprise of one township in Oakland county and one in Wayne county.

Mr. George lost patience and put the situation before the board of supervisors in Pontiac in no uncertain way and asked why the road could not be concreted during the next season.

He was informed of the peculiar system of county road building in effect in Oakland county. There are twenty-five townships in the county. From a large number of them there had come objections, two years before, to the abandonment of the old township method of highway improvement, and it had finally been necessary to make practical pledges that each township would receive each year at least one mile of improved road, unless arrangements were made among townships to exchange their shares in any particular year. The bond issue had failed to carry and the county depended for funds on the two-mill tax which the county board is authorized by law to levy.

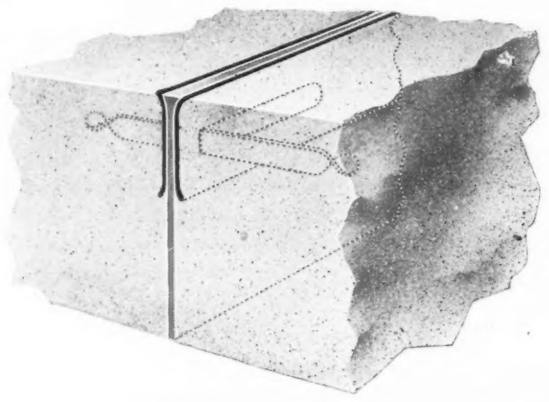
Should the county board of supervisors undertake the improvement of a long stretch of road in Bloomfield township, it would consume so much of their funds as to make impossible the completion of the of the roads pledged to other townships.

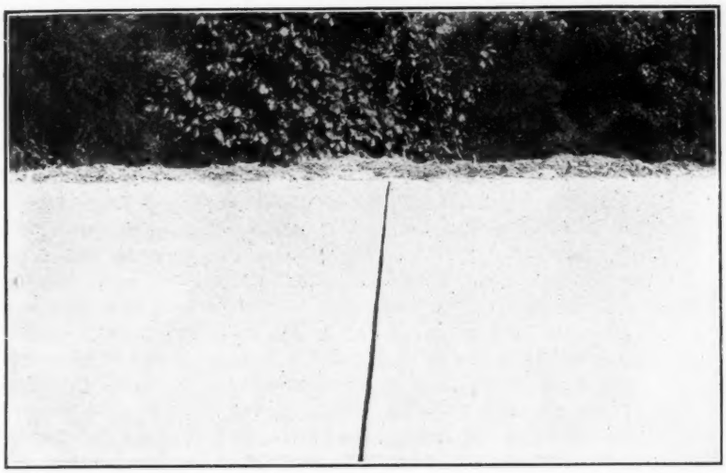
As a means of removing the difficulties, Mr. George, after conference with a number of friends, proposed that if the county would complete in 1915 a 16-foot concrete road from Birmingham toward Detroit to the end of the existing road already built in Royal Oak township, he would duplicate the reward paid by the state, namely $3,400 a mile. The further condition was imposed that Birmingham must pave its mile of main street. With the mile in Birmingham the road is nearly six miles long.

This offer met the approval of the state highway commissioner and was duly considered by the board. It meant the obtaining of half the trunk-line highway at a cost to Oakland county of about $8,000 a mile. The result was that the county accepted the offer. That was last October. This spring Mr. George, jointly with the board, signed the contract which gave the work of building the road to the R. D. Baker Construction Company, of Detroit. They are to complete it by August 15 and the work is now under way.

It is generally understood that Edwin S. George has levied on a number of his friends and neighbors to make up that $3,400 a mile for about five miles of road, but that is not an official announcement.

TRANSVERSE EXPANSION JOINT *having steel plates to protect the edges of the sections of concrete, the plates being anchored in the concrete as shown by the dotted lines, and the space between them filled with a compressible asphalt felt.*





EXPANSION JOINT *and its protection as they show in the surface of the pavement when in use.*

This successful bit of highway promotion woke up the business men of Pontiac. That busy county seat saw a concrete highway, broad and inviting to motorists and farmers alike, coming within six miles, and stopping there. More than that, Pontiac is the terminus of three miles of improved road running in a northwesterly direction, tapping farm country and forming the first step in better travelling facilities to the towns of Holly, Clarkston and Waterford. This break of nearly six miles in a line now having nearly seventeen miles of concrete highway is hilly, rough and hard to travel.

O. J. Beaudette, manufacturer of auto bodies, and W. L. Day, manager of the General Motors Truck Company; E. P. Waldron, since made president of the Pontiac Commercial Association because of his connection with this enterprise, and others, began work. Mr. Beaudette started a subscription list with $1,000 and the idea that what George had done other people could do.

Regular and occasional users of the road, two hundred out of four hundred automobile drivers in Pontiac, and many others subscribed sums ranging from $10 to $100. Real estate men and owners, cottagers who find pleasure at the various lake resorts, non-resident property owners were approached and replies and checks were received from Maine to Missouri.

The subscription reached $15,300, duplicating the state reward on all of the missing link except about a mile which would have been built during the present year as Bloomfield township's share of the general fund. The list is said to be one of the best testimonials to the value and appreciation of good roads that has ever been compiled in Michigan. It represents free gifts from every class and condition of road users from the business firm which will use the highway daily, to the summer resident who may drive over it half a dozen times in a season, and the man living across the county who will probably get most satisfaction from it simply because he knows it is there.

Then the committee went before the supervisors, wanting the road completed in 1915. The townships rebelled. The Birmingham-Royal Oak five miles of construction, even at $8,000 a mile or thereabout, would drain the general road fund until there was just about enough money left for those scattered twenty-three bits of road promised the rest of the county. Some local statistician figured out that it was going to take seventy-six years at the present rate of work to finish all the county roads, and not one was willing to make it seventy-seven. The board left the matter in the hands of the road committee. This committee raised the further objection that there was not room for the double-track interurban line of the Detroit-Pontiac railway on about a mile of the road on which it was located.

So the subscription committee went forth once more and interviewed property owners on the line in the Bloomfield district, and imparted so much of their own enthusiasm to those property owners that a promise of a free gift of enough land for the tracks was made.

Then the workers tackled the apportionment problem. They showed that each township would lose from $250 to $1,000 if the gifts of the subscribers were turned back. At this moment they also proposed a compromise, which was that the road be prepared between Pontiac and Birmingham in 1915 and the work actually finished before July 1, 1916. This was accepted. The compromise included the building of one and a third miles of concrete road on that stretch this year and work will shortly be started on it.

The entire road is now assured, linking the two automobile building cities of Detroit and Pontiac with a continuous modern pavement. That it is to be ready next year, instead of several years from this time, is due to the efforts of the committee, E. P. Waldron, chairman; O. J. Beaudette, treasurer; W. L. Day, Dr. R. Y. Ferguson and Harry Coleman. The chief thing, however, is that Oakland county has awakened to the need of a bond issue for good roads, large enough to make possible the completion of all main highways within three or four years, before the state of Michigan gets thru paying rewards. Oakland has been contributing to the work in other counties and is just beginning to realize that she must hurry to get a return on her money.

The board of county road commissioners of Oakland county, Mich., of which Pontiac is the county seat, is composed of John Adams, chairman; Thomas Lytle and Robert Gamer. Martin Deglopper is the engineer, Floyd B. Babcock, clerk, and Stanley C. Rogers, deputy clerk.

The contract for the section southeast of Birmingham was taken by the R. D. Baker Construction Co., of Detroit, at the following prices:

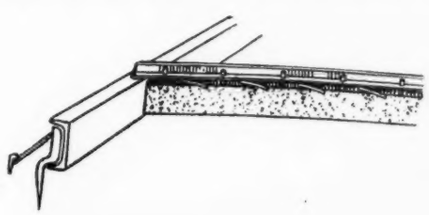
Grading per 100 feet, including preparation of road bed, rolling, forming shoulders and improving ditches, $14.22.

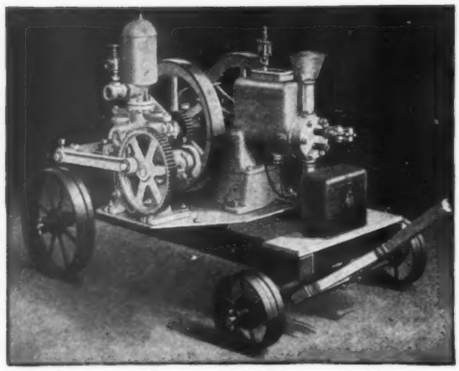
Concrete in roadway, complete in one course, including rolling sub-grade and sprinkling completed pavement, per square yard, $1.67.

Hard-burned clay tile, per linear foot, 4-in., 10 cents; 6-in., 15 cents; 12-in., 40 cents; 15-in., 70 cents.

Furnishing and placing headwalls, culverts, culvert extensions or repairs per cubic yard, $6.00.

SIDE FORMS *for concrete road and method of placing protection for expansion joint, showing their relations in use.*





PUMP *which supplies water thru a pipe line along the road is of a type similar to this C. H. and E. power-driven piston force pump.*

Furnishing and replacing reinforcing steel in culverts, per pound, 3 cents.

Building concrete catch-basins with cast-iron inlets, each, $1.25.

Completed road constructed according to specifications, based on quantities as estimated, but without steel protection plates, $58,400.06.

Complete road, including joint protection, $59,674.27.

The width of the concrete is 16 feet and its total area is 42,000 square yards. The cement is 8 inches thick in the center and 6 inches at the sides and it has no curb.

The specifications used are those of the Michigan State highways, Class F, cement concrete. Under them the concrete roadway is made 6 inches thick in one course, the mixture being 1 part portland cement, 1½ parts of clean, sharp sand and 3 parts of broken stone or gravel.

The sand must be free from loam, clay, vegetable matter and dust, well graded from fine to coarse so that the voids shall not be greater than 33 per cent. as determined by saturation, all the sand passing a ¼-inch mesh screen when dry. The coarse aggregate may be either clean, hard, durable crushed stone or screened washed gravel, graded in size from material retained on ¼-inch mesh to that passing 2½-inch mesh screen. Batch mixer is required.

Transverse expansion joints are required at least every 30 feet of the length of the pavement. The joints may be made concrete are then smoothed off and the joint filled with paving pitch not soft enough to bleed in hot weather nor of heavy 3-ply tar paper, or may be formed by placing a beveled ½-inch board shaped to fit the crown, which is withdrawn after the concrete has set. The rough edges of the brittle enough to chip in cold weather. The lower price for the completed pavement, quoted above, is for the use of this sort of joint. The Baker steel joint protection plate was also bid upon, and increases the total cost of the pavement about $1,275.

The supply of material for a concrete road is one of the most important practical details connected with its construction. The contractors have supplied themselves with the Weller elevating, washing and storage equipment, which reduces the hand labor to a minimum. It is made by the Weller Mfg. Co., of Chicago. The pit gravel and sand are delivered in drop-bottom cars which dump into a track hopper placed below the railroad track. In this hopper is an apron conveyor which delivers the material to a standard Weller stone and ore elevator, which carries it to a sand washer set on top of the storage bins, about 20 feet above the ground level, making the total left about 30 feet. The washer delivers sand to one of the two storage bins and gravel to the other. Each bin is about 11 feet square and 11 feet deep and is set about 10 feet above the ground, so that teams or industrial railway cars run under them and receive their loads directly.

The approved method of delivery of materials to a concrete road under construction is by an industrial railway with a small locomotive and trains of contractors' dump cars. If the sand and gravel washing plant can be located near the middle point of the work on the railroad or a temporary track running from it, the cost of preparation and delivery of materials is reduced to a minimum.

The washer for concrete material is made by the Stocker Material Washer Co., of Highland, Ill. It has the advantage that the dirty water is discharged from the machine at the end where the unwashed material enters, and the clean water enters the machine where the clean gravel and sand are discharged, the material having been alternately dropped into the water, agitated, lifted out and carried a short distance forward and again dropped into the water, each time advancing into cleaner water. The chutes handling the material can be set so as to change the time which it takes the material to pass thru the machine according to the amount of washing it requires.

The water used on the work is pumped three hundred yards, three-inch pipe being used.

TRACTION-ENGINE-ROLLER *and trailer used for rolling sub-grade and hauling materials.*

UPPER CUT SHOWS *side forms joined to make them continuous. Lower cut shows two sections of the channel-shaped side rail with fish-plate attached to one of them. The plate slides under the eccentric roller on the other channel and the pins slip into the holes. A part turn of the roller binds the plate in place and makes the joint rigid.*

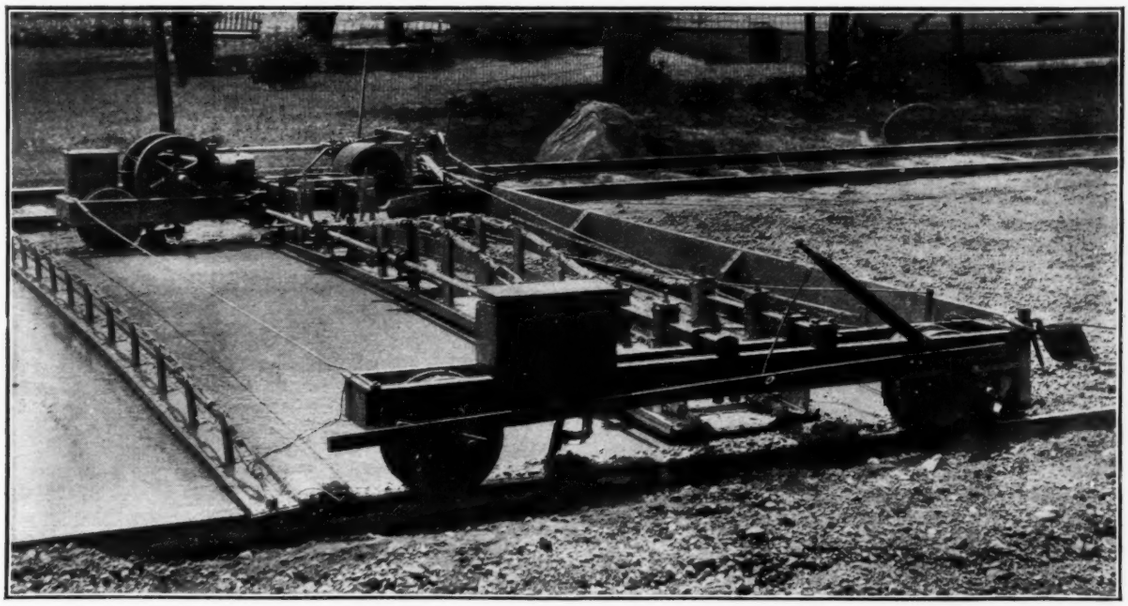
In preparing the sub-grade for the reception of the concrete pavement the Baker company use Port Huron road rollers, and other apparatus from the line of road-making machinery made by the Port Huron Engine and Thresher Co., Port Huron, Mich. The design of these rollers is exceedingly simple because the operation of a road roller is often intrusted to unskilled labor and the danger of accident, as well as the frictional wear of the machine from neglect, must be reduced to a minimum. Outside gear trains, reduced to four in number, location of shafts so that they are outside and easily accessible, simple modern valve motion, are some of the points of simplicity and convenience of maintenance which are prominent in the design.

The front rollers are so attached to the yoke that they conform to great unevenness in the roadway without strain. The rear rollers are side hung, so that the wheel base is short enough to permit short turns, a very great convenience, if not an absolute necessity many times. The axles are removable and reversible for renewal of bearings and the hubs have renewable bushings.

The concrete mixer used on the work is the batch mixer made by the Koehring Machine Company, Milwaukee, Wis. This is a modern design which may be fitted with a batch hopper or the automatic loading skip, a great time-saver in charging the mixer. It may be used with a distributing chute or with boom and bucket delivery. Another new Koehring idea is the batch meter. This may be set to ring a bell at the end of a fixed time of mixing, and counts the number of batches, so that there can be no doubt as to the thoroness of the mixing of the concrete and there is an exact measure at the machine of the volume of concrete turned out. This is one of the most valuable accessories of the concrete mixer that has been devised.

Concrete pavements are protected from the formation of longitudinal cracks due to settlement, contraction and traffic if they are lightly reinforced with such material as Kahn road mesh, which is furnished with diamonds of two sizes,

AUTOMATIC STRIKE AND FINISHING MACHINE *for concrete, giving it any desired crown; and a float in the rear transversely of the road, leveling the concrete to the desired depth; a vibrator pan about eighteen inches back of the strike, which is twenty inches wide and compresses and shapes the concrete, giving it any desired crown, and a float in the rear which finishes the surface. The machine moves by its own power, a three-horse-power gasoline engine.*



6 by 12 and 6 by 16 inches, the amount of metal varying in the four sizes of mesh bars used from 0.027 square inch of longitudinal area per foot of width to 0.079 square inch of transverse area per foot of width. The cold-drawn process used in manufacturing insures great unit strength and high elastic limit thruout. The mesh bars will bend flat when cold thru 180 degree angle without a sign of fracture.

Reinforcing material is used only in those sections of road where local conditions make such reinforcement necessary. Such conditions may be due to unstable foundations, bridges or fills where settlement is likely to occur. Approximately one-third of the section under contract will be reinforced, Kahn mesh being used as reinforcing material.

At the outset, the Oakland county commissioners made a careful inspection of the concrete roads which were built in Wayne county and decided that it would be wise to follow the practice of using armor plate joints. In the beginning of the work in Wayne county, armor joints were not used and roads so constructed have given relatively poor results, cracks soon appearing and the joints themselves soon showing serious disintegration. Later roads constructed in Wayne county with armor joints are now in good condition with the exception of a few longitudinal cracks which are repaired by tarring. On the Oakland county road, Baker armor joints are being used. These are ⅛-inch thick and present only a thin surface of metal on the wearing surface of the road. This metal strip wears down evenly with the road surface. The joint in position in the surface of a road is shown by the accompanying illustration.

The contractor is using side rails to insure true grade. These are of the Baker type and consist of 6-inch by ⅜-inch channels locked by means of an eccentric pin and fish plate. These rails are of unusual strength so as to permit of the direct compacting of the concrete and rolling of the road surface before their removal. They are set in place by means of small supporting stakes driven in line at the side of the road and teed to grade from one supporting stake to another. The rails are held true to grade and line by means of diametrical guys and braces operating in connection with the supporting stakes. The accompanying illustration shows the position of the side rails in place.

Instead of finishing the road surface by hand as has usually been the case, this work is finished by means of a machine, which permits the use of a plastic mix instead of a wet or sloppy mix, such as has generally been used in concrete road construction where hand finishing has been employed. In hand finishing the workmen are often inclined to take advantage of any opportunity to lessen the physical labor involved, and since the wet or sloppy mix is easier to handle than the plastic mix, it has generally been employed, with the result that much of the cement is washed thru and the finished surface is impoverished and weak, cracking or breaking easily and sometimes quickly disintegrating. The Baker automatic strike and finishing machine used on this road produces a uniform texture for the entire road surface and does away with three to five men, depending upon the width of the road.

When finished the concrete surface is covered with earth and kept dampened for a period of seven days.

THE FINISHED PAVEMENT.

STREET LIGHTING OF LONDON

By W. B. Conant, Concord, Mass.

London, England, is not a city under one central city government, nor is it a system of co-ordinated boros, like New York City. It is rather a series of areas, each under its own boro government, with certain sanitary and improvement features under more or less control of a body called the London County Council, whose sphere of influence includes many of the boros which go to make up the metropolitan district called by the general name London.

The city of London proper covers but a square mile or so near the center of the 4,000,000 or 5,000,000 population which may be counted as within the reach of its attraction.

Street lighting is not one of the matters under the control of the London County Council, and so the boros within Greater London show as great differences in lighting practice as may be found in a like number of municipalities anywhere. This article describes some of the installations in the central city of London and adjoining boros, enough to show what varieties of lighting systems, both electric and gas, may be found in the more progressive sections of London.

THE public lighting of the streets of London, England, presents some interesting features, partly because for the most part it is a recent adaptation of modern equipment to antiquated conditions. Tho the modernizing of London street lighting came tardily, the present installations in several of the boros comprising the Metropolitan District are admirable.

Beginning with "the City," London's original square mile, now given over to wholesale and financial houses, the principal lighting provision is by means of 430 new Oliver "Oriflamme" arc lamps, of 2,000 and 3,000 candlepower, mostly centrally suspended over the narrow streets, at the intersection of two taut guy wires secured to the buildings on either side. At intersecting ways the lamps, pendent from their supports, which are secured to the corners of buildings diagonally opposite, are thus located opposite the centers of the cross streets. A parliamentary act gives the city authority to attach necessary wires and fixtures to private property. In the case of the suspended arc lamps the winch box from which the lamp is controlled is located on the building wall, while on a wall opposite are located the conduit containing the feed wires and a cutout controlling the lamp. Incandescent lamps in clear globes are also installed as auxiliaries on refuges in streets, etc. Exceptions to the prevailing type of arc lamp in the city are 14 Excello arcs of 4,000 candlepower each, which are erected on tall iron poles in the center of Holborn (street), which from Newgate to Holborn Bar is sufficiently wide to make suspension wires impracticable. Several arc lamps of this type are also installed on the intersecting Farringdon street.

The city let the contract for supplying current to the 2,000 candlepower lamps, on a ten-year contract, to the City of London Electric Lighting Company, at £17 or about $83 per lamp a year, and for the 4,000 candlepower lamps £21 or about $102 per year.

The next boro to the west of the city is Holborn. This boro is divided between business and residential sections, the latter known as Bloomsbury. The principal thorofare is the street called High Holborn, continuing westward as New Oxford street. The lighting of Holborn boro is divided about equally between gas and electricity. Roughly, the former is typical of the western and the latter of the eastern half of the boro. The electrical equipment is entirely of incandescent lamps, in clear glass lanterns. Those on the main thorofare are of 600 watts, while on secondary and side streets lamps of 400, 300 and lower wattage are installed.

New Oxford street, from Kingsway west, is lighted by high pressure gas lamps, which are practically equivalent per unit to the 3-lamp groups of 600-watt tungsten lamps which light High Holborn, the continuing street toward the City. Likewise, side streets are lighted with gas lamps of equivalent candlepower to the incandescent electric lamps of the east half of the boro. Notable features of the High Holborn lamps are several group lamps which are installed at the foot of Gray's Inn road, this locality being known as Holborn Bar, the site of an early gate to the City. Group incandescents of 600 watts each, with a few nitrogen-filled lamps in experi-

HOLBORN STREET, *in the "City" of London, is wide enough to allow this 4,000-c.p. Excello lamp on a refuge for pedestrians in the center of the street, an exception to the general plan of arc lamps suspended by cross-wires.*

HIGH HOLBORN, *in Holborn boro, has many 600-watt incandescent lamps in clusters of clear glass lanterns. Note location on a refuge in the center of the street, with refuse box and entrance to underground men's lavatory.*

mental use, are installed at lavatories located in the center of High Holborn.

Still continuing westward, the next boro is St. Marylebone, with the famous Oxford street as its southern boundary, and the fashionable region of the "West End" located just to the north of this street of fine shops. Oxford street roadway comes within the jurisdiction of the municipal lighting plant of St. Marylebone boro. On the opposite side of the street the city of Westminster begins. Oxford street, thruout its 1.5 miles of length, is lighted by 84 flaming arc lamps of 10-ampere capacity and of the type known as the Union Excello. Generally, lamps are installed in pairs pendent by swan necks from high poles erected in the center of the street. There are also six lamps similarly installed on Regent street.

The posts are of iron, with ornamental iron work between the branches at the top, and are painted black. They are spaced at 50 to 65-yard intervals, and the arc of the lamp is uniformly 25 feet above the roadway. The lamps are connected nine in series and are operated on 480-volt direct current, exerting 1,500 to 2,000 candlepower. Of the 90 arc lamps in service, 52 are operated ordinarily all night, with 3,940 hours of service a year, and 38 are operated until 12:30 a. m., with 2,400 hours of operation a year. For the 90 lamps the lighting department charges the boro £1,837 or practically $9,000 a year.

Thruout the secondary business streets and the residential section, incandescent lamps are operated. Nitrogen-filled lamps are being gradually introduced where large units are required. This is particularly true of the region about Marylebone road and Baker street, where an ornamental lighting arrangement is installed, consisting of 5-lamp and 3-lamp standards at intersecting streets and in front of the Baker Street station. The incandescent units are of 300, 200 and 100 watts, and are enclosed in alba balls.

Gas lanterns have been converted to uses of electricity. Three-burner lanterns at street intersections, and in central locations on refuges, now contain three 80-watt tungsten units; double-burner gas lanterns are equipped with two 60-watt lamps, and single burner lanterns now have two 40-watt tungstens. The municipal lighting plant supplies 240-volts direct current.

The mode of adapting the gas posts and lanterns to electric uses is of interest. The conductor was carried up thru the center of the lantern by a small pipe to a position above the reflector, which is of double convex shape and white enameled. The pear-shaped bulbs are installed thru openings in the lower side of the reflectors, just large enough to admit their stems. All two-lamp lanterns are square, the lamps being installed at right angles with the street. The poles are 10 and 11.6 feet high. Three-lamp lanterns are hexagonal, on 15-foot posts, and the reflector is slightly convex, the lamps being grouped closely in the center. Refuge posts and lanterns are painted a dull red, while those at curbs are dark green.

All incandescent lamps in this system are controlled by a hand switch located in the crotch of the supports of the lantern. The same force of men that cleans and renews attends to the lighting, each man caring for 150 lanterns. There are 3,550 incandescent lanterns in St. Marylebone, 85 of them 3-lamp refuge lights and the remainder 2-lamp curb lights.

The city of Westminster, lying directly south of St. Marylebone, is at present provided with a rather mixed and inefficient street lighting system. Old-style arc lamps and high-pressure gas lamps are interspersed. The latter provide a fairly brilliant lighting for the important Victoria street,

FLAMING ARC LAMPS *in center of Oxford street, on the line between St. Marylebone and Westminster boros.*

STREET LIGHTS IN ST. MARYLEBONE.

Three-light group of incandescent lamps in old gas lantern.

Two incandescent lamps in an old gas lantern.

STREET LIGHTS IN FULHAM.

One-hundred-watt groups of incandescent lamps in old arc light fixtures.

A single incandescent lamp in an old gas lantern on a side street.

while the Strand is helped out by the many electric signs and window lighting. Otherwise, this noted thorofare would be dismal by night.

Lighting of the Thames embankment is cared for by the London County Council. The installation consists of large candlepower incandescents in gas globes supported on "dolphin" iron standards erected on the embankment wall, and arc lamps on high poles on the opposite curb. Grouped incandescent units in the center of the refuges are auxiliaries.

The lighting of the western boros of Fulham and Hammersmith is much alike, and is marked improvement over the gas lighting that formerly prevailed. In both boros the principal streets are lighted by groupings of 4, 5 and 6 100-watt tungsten lamps in clear glass bowls. The electricity supply of Fulham is by a municipal plant which also does a general commercial and residential lighting business. Present lighting equipment is an adaptation of arc lamp posts to the uses of the glass bowl groups and the conversion of gas lanterns on secondary and side streets to the uses of incandescent lamps in much the same manner as the boro of St. Marylebone has accomplished this end.

The electric lighting of Fulham is co-extensive with the streets in which the municipal cables are laid, only a few unimportant ways not so provided having the gas installation that was general thruout the secondary streets of the boro a few years ago.

The poles and brackets formerly used for arc lamps were remodeled and an arm of 2-inch iron pipe 8 feet long, suitably braced, was provided to replace the circular bracket in which the arc lamp was formerly suspended. At the end of the arm is suspended the plain glass bowl, attached to the hood of the old arc lantern. The bowl hangs 22 feet above the street, and contained in it is a group usually of 6 100-watt tungsten lamps, tho in certain instances 5-lamp groupings are employed. The lamps are of the round-bulb type and are socketed thru round openings in the flat, vitrified enamel metal reflectors, the central lamp of the group being installed 2 inches lower than the other units, whose shoulders fit closely into the apertures in the reflectors. There is a space of about 2 inches between the cheek of the central bulb and those of the units ranged around it. The lanterns have an overhanging hood extending 3.5 inches outside the radius of the glass bowl. The Croydon arc-lamp clutch is employed to hold the lantern in position in the socket. A wire running from a winch contained in the base of the post and thence up the pole and thru the arm enables the lantern to be lowered from its position for the purpose of cleaning and renewing, after the same manner as an arc lamp is controlled. The posts carrying these incandescent groupings are 125 to 150 feet apart, zigzagged on opposite sides of the street. To the casual observer, the spacing seems excessive, considering the relatively small capacity of the groups of units, viz: 500 to 600 candlepower, as compared with the 1,800-candlepower incandescent groups on the chief streets of Holborn boro, or the 3,000-candlepower pairs of arc lamps in Oxford street, St. Marylebone. The streets of Fulham are not, however, so important as those of the other boros mentioned, but, considering the frequent omnibus and taxicab traffic in Fulham, the lighting provision cannot be regarded as adequate.

In wiring for these incandescent circuits the cables formerly used as the power conductors for the arc lamps were utilized. The 6 and 5-lamp groups are the lighting provision in Fulham Road, Fulham Palace Road, North End Road and

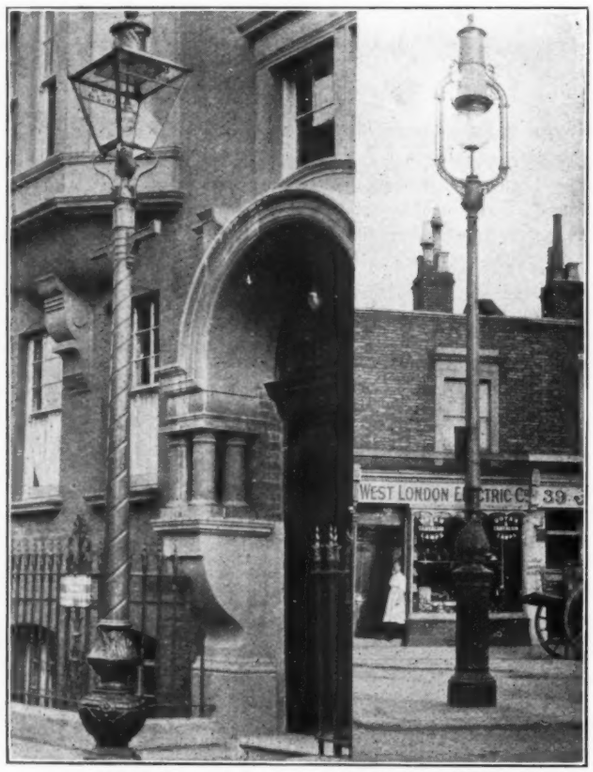
Lillie Road. In the ordinary refuges in these streets, central posts, carrying a single glass bowl on a swan-neck-shaped bracket, contain four 80-watt round-bulb lamps. Double-arm posts are provided on the refuges at the intersection of important streets, each arm carrying a 4-lamp group, installed in the same manner. The side streets are lighted by two 80-watt pear-shaped lamps contained in the converted square gas lanterns, having slightly convex enameled reflectors, the two units being installed on a line at right angles with the street and sidewalk.

The posts of all the street lamps are painted a dark green, except those indicating the nearness of fire stations, which are a dark red. The incandescent units are installed in series of a half dozen and are switched on by separate switches for each series from group switchboard. The circuits on the side streets are used for residence lighting as well as for the street lamps and are 3-wire circuits, one of the negative wires being used as a switch line for the street lamps. All the units are operated on 200 volts alternating current.

In Fulham Palace Road, on which tramways of the London County Council operate, 2-lamp groups are installed, one unit on an arm on either side of the pole which carries the suspension wires for the overhead conductor. The lamps are on a line parallel with the street curb. These are mainly 100-watt units, and have horn-shaped reflectors of opaque glass.

The street illumination of the boro of Hammersmith closely resembles that of Fulham, which it borders on the southeast. The character of this district is similar to that of Fulham, in that it contains the homes of middle class workers, with many little local businesses and small manufacturing industries. The principal streets are lighted by 5-lamp groups of 100-watt units, of the improved drawn-wire type, known in England as the Mazda, Osram and Ediswan. The groups are arranged in clear glass inverted bowls, the reflectors being flat, of white enamel, thru which the necks of the bulbs enter their sockets, which are installed just above the reflector, except that the central lamp of the group is installed with a 2.5-inch section of duct. The faces of the surrounding lamps are 2 inches distant from that of the central unit. The bowls are provided with a 3-inch hole in the bottom, for the better ventilation of the lamps.

On the streets on which tramcars operate, a single 100-watt lamp is installed on an arm on either side of the trolley pole. These lamps are provided with conical opaque glass reflectors. On the streets of secondary importance are 5-lamp groups in inverted glass bowls, suspended on goosenecks formerly used for arc lamps. These lights overhang the roadway, and are spaced about 125 feet apart, alternately. The side streets are lighted by single 100-watt metal filament lamps in white enameled, slightly convex reflectors, in square lanterns formerly used in gas lighting. The lamps in the boro are operated on 220-volt alternating current. The main groups in the principal streets are switched on in series from the station, but the side street lanterns are lighted singly by the operator throwing a switch for each lantern.



STREET LAMPS IN HAMMERSMITH.

One-hundred-watt incandescent lamp with reflector in old gas lantern on a side street.

Six-hundred watt incandescent lamp in an old arc lamp fixture.

WOOD BLOCK AND GRANITE FOR BRIDGE FLOORS

By Edward A. Byrne, Assistant Chief Engineer, Department of Bridges, New York City.

The bridge floor problem of New York, especially on the bridges over the East River, is one of particular difficulty because of the exceptional conditions under which the pavements are laid, the enormous traffic to which they are subjected, and the manner in which this traffic must be handled, bringing unusual severity of wear upon the pavements. This article, which is extracted from a paper by Mr. Byrne before the American Road Builders' Association, gives some account of the difficult conditions experienced and the success of the department in meeting them as well as a statement of the practice which has been developed after years of experience.

The article treats of the floors of the many small bridges under the department, as well as of the long bridges over the great river. The special means devised for meeting a particular difficulty in connection with the traffic over the Brooklyn Bridge will be of interest.

THE Brooklyn bridge has had an excessive cost of maintaining the roadway pavements and the bridge department is doing much with a view of decreasing this cost.

The bridge has two roadways, each 16 feet 9 inches in width, and a trolley track is laid on each of them near the inner curb; this arrangement permits of the passing of but a single line of vehicles. This concentration of traffic tends to wear out the pavement very rapidly.

The main bridge is 3,455 feet 6 inches in length, and the two approaches 2,550 feet 6 inches in length, a total length of 6,006 feet.

The pavement of the main bridge consists of 2½-inch by 10-inch spruce plank, laid transversely on 3½-inch to 5-inch creosoted yellow pine timber, laid longitudinally. This underflooring is carried on steel cross beams. The daily traffic averages 4,000 vehicles, and this necessitates the renewal of the spruce planking twice during the year. The planking on the up grade averages four months' wear, while that on the down grade averages six months, and that on the part near the center, which is nearly level, averages eight months.

The question of weight is of vital importance, and any change in design must provide that the dead load on the structure be not increased. The present pavement weighs only 25 pounds per square foot.

It was finally decided to lay several sections of wood blocks and cork asphaltum blocks on an underflooring of untreated yellow pine timber. The cork asphaltum blocks failed completely and they have been replaced by wood blocks.

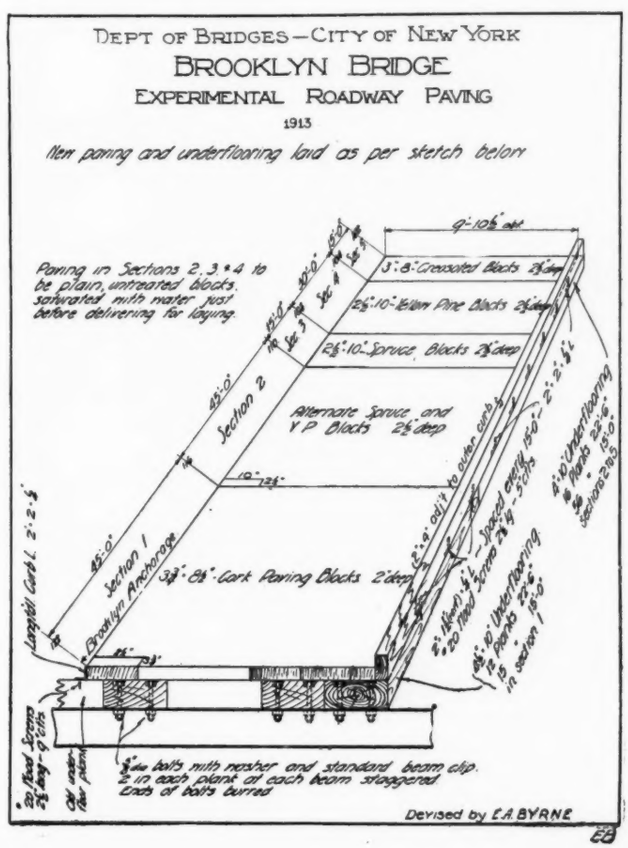
The accompanying diagram shows the plan for the experimental pavements.

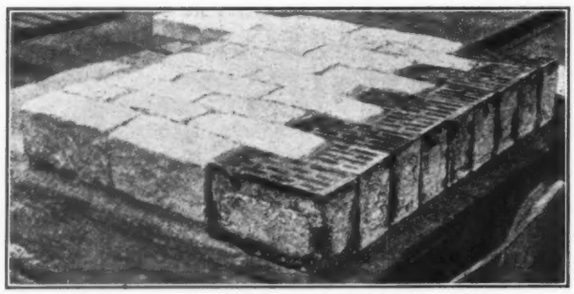
The wood blocks all were 2½ inches deep, the creosoted blocks were cut from 3-inch by 8-inch planks, the untreated yellow pine blocks from 2½-inch by 10-inch planks, and the spruce from plank of the same size.

The creosoted blocks have given the most satisfactory results, and we expect to pave the main bridge with this kind of block. This pavement weighs 26½ pounds per square foot.

The pavement of the approaches consists of granite blocks on portland cement concrete foundation. In relaying this pavement, granite blocks 5 inches in depth were used, laid on a 1-inch sand cushion with cement grout joints. The blocks removed were 8 inches in depth on a 2-inch cushion with tar and gravel joints. The foundation of the old blocks was in good condition and was not removed, but an additional layer of concrete was laid on top of the old foundation, so that the new blocks when laid would be at the old grade.

In connection with this repaving, I designed a cast iron and concrete block to be laid along the curb. Most of the vehicles crossing the bridge use the curb for a brake, and consequently the blocks along the curb wear out before the balance of the pavement. This wearing of the blocks was also quite irregular, producing a series of ridges and depressions which interfered with the speed of the movement of the vehicles, as well as causing severe jolting of their springs. These blocks required frequent repair, and where traffic is so concentrated these repairs were of great annoyance to the traveling public.


DEPT OF BRIDGES—CITY OF NEW YORK
BROOKLYN BRIDGE
EXPERIMENTAL ROADWAY PAVING
1913
New paving and underflooring laid as per sketch below
Paving in Sections 2, 3 & 4 to be plain, untreated blocks, saturated with water just before delivering for laying.
3"x8" Creosoted Blocks 2½" deep
2½"x10" Yellow Pine Blocks 2½" deep
2½"x10" Spruce Blocks 2½" deep
Section 2
Alternate Spruce and Y.P. Blocks 2½" deep
Section 1
3½"x8½" Cork Paving Blocks 2" deep
Brooklyn Anchorage
Devised by E.A. BYRNE



CAST-IRON AND CONCRETE PAVING BLOCK *designed for special service next the curb on New York's long bridge, where the wear is exceptionally heavy.*

The cast iron and concrete blocks have proved satisfactory and their cost has fully justified their use. The blocks are of cast iron 6 inches deep and 4½ inches wide, and are made in two lengths, one 5 inches long and one 10 inches long. These blocks are cast hollow with a top face 1⅛ inches thick. They may be best described as an open box or crate, having ends and bases of ¾-inch square metal. Recesses are cast in the top face to prevent slipping. The hollow space is filled with portland cement concrete (1:2:4), which is thoroly set before the block is placed in position in the pavement. The blocks are laid in conjunction with the granite blocks, with which they bond with a lap joint of 5 inches. In order to decrease the cost of the block I have reduced the length of the 10-inch block to 8 inches.

It may be of interest to mention the great amount of traffic the four East river bridges accommodate.

From a traffic count taken October 30, 1913, these four bridges carried:

10,128	Elevated Railroad Cars
21,364	Surface Railway Cars
24,251	Vehicles
314,797	Elevated Railroad Passengers
365,185	Surface Railway Passengers
47,558	Passengers in Vehicles
15,452	Pedestrians
742,992	Total people crossing bridges

This shows an increase of 12.6 per cent. over 1912 traffic, which in turn was an increase of 4.7 per cent. over 1911.

The traffic count of vehicles taken during the years 1909 to 1914 on Queensboro bridge may be of interest, as it shows a most remarkable increase.

In 1909 the daily average was	1,170
In 1910 the daily average was	2,110
In 1911 the daily average was	2,190
In 1912 the daily average was	3,640
In 1913 the daily average was	6,570
In 1914, May, the daily average was	7,500
In 1914, June, the daily average was	8,760

The increase in vehicle traffic over the Williamsburg bridge since its opening has been over 250 per cent. In 1904 the daily average was 2,026, and in 1913 the daily average was 7,417.

The Williamsburg bridge, which was opened to vehicle traffic in December, 1903, is a suspension bridge, having two roadways, each 20 feet in width. The main bridge is 2,793 feet in length from anchorage to anchorage, and the two approaches have a combined length of 4,515 feet, making a total length of bridge of 7,308 feet, which means an area of 32,480 square yards of pavement to be maintained.

The approaches are paved with Medina (N. Y.) sandstone blocks on a portland cement concrete foundation (1:2¼:4½). This foundation varies in depth according to the different bases on which it rests. On the earth fill it is 6 inches in thickness; on buckle plates, with buckles up, it varies from 4 inches to 7 inches; and on the corrugated trough plates from 3¼ inches to 12 inches.

This pavement, of which there are 20,065 square yards, has worn very rapidly. The Medina block is a very soft stone and the blocks at and near the curb have shown a reduction in depth of 4 inches, due to wear. The specifications for these blocks required a thickness of not less than 4 inches, nor more than 5 inches, a depth of not less than 6 inches, nor more than 6¼ inches, and a length of from 7 inches to 12 inches. The department, when making repairs, has substituted a granite block for the Medina.

The main bridge is paved with creo-resinate long leaf yellow pine blocks, 4 inches in depth and cut from 4-inch by 8-inch planks.

In addition to the four East river bridges, the department has under its jurisdiction 38 smaller bridges, which have cost the city of New York over $37,000,000 to construct. The sum includes the cost of land taken for bridge purposes.

The policy of the department has been to replace all the various types of pavements, with the exception of granite block and wood block, and to eliminate the use of Medina block, sheet asphalt, asphalt block, plank and macadam, which, together with granite and wood block, constitute the various kinds of pavements in use on the city's bridges.

The original cost of the wearing surfaces of all the bridges of the department is less than 1 per cent. of the cost of construction of these bridges, and altho the city authorities have expended money for the construction of bridges it has been quite a difficult matter to have them appropriate funds for repavement purposes, and consequently it is only on the smaller bridges that progress along this line has been made.

The first bridge in the department where the pavement was entirely reconstructed was the Meeker avenue bridge over Newtown creek, a branch of the East river.

The bridge cost the city $142,500. It was built in 1890, and in 1903 its roadway pavement, which consisted of 3-inch yellow pine plank on a base of similar material, was replaced by a wood block pavement.

The plans for this work were prepared by me and the work was done under my direction. It was the first bridge in New York City where wood blocks were used. Since this pavement was laid in 1903—eleven years ago—it has not required any repairs and has not cost the city one cent for its maintenance.

The bridge is a center bearing draw span 200 feet in length and has two steel approaches having a length of 85 feet, making a total length of bridge of 285 feet. The roadway is 20 feet wide. It accommodates an average daily traffic of 900 vehicles.

I believe it would be of interest to state how this pavement was laid. All the old timber was removed and the steel work was thoroly cleaned and painted. On the stringers was laid a sub-base of 3-inch by 12-inch untreated long leaf yellow pine, dressed on sides and edges to 2¾ inches by 11¾ inches. This planking was bolted to the steel stringers by ½-inch hook bolts and spiked to four lines of wooden stringers, which in turn were bolted to the steel stringers. On the flooring was laid a waterproof course, consisting of four layers of single-ply roofing felt, tarred to each other and on top, but not tarred to the flooring.

This waterproofing was laid with the ends turned up at the curbs and at the ends of the draw and approach spans, so as to form a trough or pan. On this waterproof course were laid the wood blocks, 3 inches in depth, cut from 2½-inch by 6-inch plank. These blocks were long leaf yellow pine and were treated by the creo-resinate process. They were laid at right angles to the traffic, with close joints.

After the blocks were laid, coal tar was poured on them and squeegeed into the joints, one-half gallon of coal tar being used to a square yard of pavement. A layer of white beach sand, which had been artificially dried, was spread on the blocks and broomed into the joints until they were completely filled. The under side of the sub-base was painted one coat of graphite paint.

The pavement has worn remarkably well. About 10 per cent. of the blocks have splintered, but they have never heaved up or shown any signs of swelling.

The waterproof course is perfect and the steel structure under the pavement is always clean. All the work, with the exception of the waterproofing, was done by department mechanics, at a total cost of $3.75 per square yard, including sub-base and waterproofing.

On five other bridges (Metropolitan avenue, Washington avenue, Strong's Causeway, Little Neck, Third street) in the department, wood block has replaced wood plank.

On four bridges (Vernon avenue, Willis avenue, University Heights, City Island) wood block has replaced asphalt.

Two old structures which had wood plank for pavements have been rebuilt and wood block has been used as pavement.

We have two of the ten bascule bridges (Hunters Point avenue, Third street) paved with wood blocks, including their movable spans.

In the design of new bridges I am of the opinion that when weight is the factor, wood block on a timber base is the most satisfactory pavement that can be used—where the conditions permit of the use of a heavy material, granite block is preferable. We have had most satisfactory results with untreated yellow pine timber as a sub-base with a waterproof course of felt, and equally good result with creosoted yellow pine timber without this waterproofing course.

Where the design calls for a wood block pavement on a timber floor, the following is suggested as a specification which will give a satisfactory result:

The sub-base shall be of untreated long leaf yellow pine timber of prime inspection, dressed on sides and edges to a uniform size, laid with close joints and fastened to the supporting stringers by means of screw bolts ⅝ inch in diameter, so spaced that every course of planking shall be bolted at each supporting stringer by two bolts.

The heads of bolts shall finish flush with top of timber, have flat wrought-iron washers under head, and at the end have wrought-iron clips, shaped to the form of the top flange of the supporting stringer. Lock nuts shall be provided for each bolt.

The countersunk bolt holes, after bolts have been fastened, shall be flush with cement mortar, affording an even surface on which to lay the wood block pavement. On this untreated flooring there shall be laid four layers of single-ply felt, tarred to each other and on top.

The wood blocks to be not over 3 inches in depth and cut from plank not over 3 inches thick and 8 inches wide. The blocks to be laid with close joints at right angles to the center line of the bridge, with each longitudinal joint broken by a lap not greater than one-half the length of the block.

After the blocks have been laid, coal tar or paving pitch shall be brushed into all joints in the proportion of ½ gallon to 1 square yard of pavement. This quantity to be used with 3-inch blocks; proportionate amount when blocks are of less depth.

Immediately following the brushing of the tar or pitch, fine beach sand, which has been artificially heated, shall be thoroly brushed into the joints, filling these joints completely. On top of the pavement there shall be laid a layer of fine brown sand ½ inch in depth.

It is quite important that the drainage outlets be designed and located so that they will actually drain the surface of the pavement.

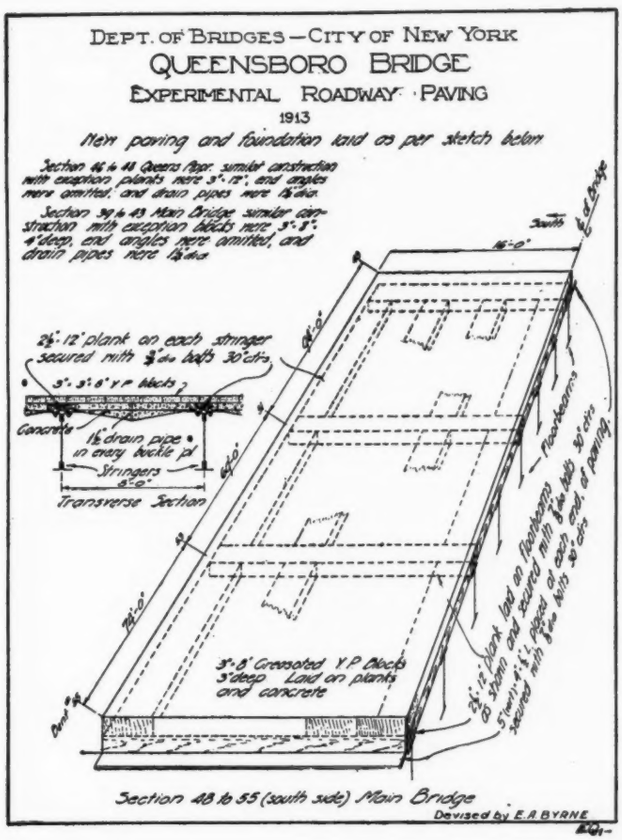
Transverse angles to arrest movement of the blocks under traffic should be placed at points most suitable to the conditions. The spacing will depend on the amount of traffic and design of the structure.

These angles should rest on the supporting stringers, to which they should be bolted, and the vertical legs shall finish ½ inch below the surface of the pavement.

In plans that call for the placing of trolley tracks within the roadway limits, the details should be so designed that the rails can be installed and maintained with the least possible interference with the pavement.

This has been done at two of the department bridges where wood blocks are used. At one (Vernon avenue bridge) the rails can be removed without any interference with the pavement; the rail bonds can also be replaced in like manner. At another (Borden avenue bridge) the tracks can be renewed with the removal of less than one-third of the area of the pavement that generally is necessary in work of this kind.

We have been able to do this by supporting the rails on the steel underflooring independent of the timber sub-base of the pavement and by laying longitudinally two courses of wood blocks along each side of the four rails.


DEPT. OF BRIDGES—CITY OF NEW YORK
QUEENSBORO BRIDGE
EXPERIMENTAL ROADWAY PAVING
1913
New paving and foundation laid as per sketch below
Section 46 to 48 Queens Approach similar construction with exception planks here 3"x12", and angles here omitted, and drain pipes here 15" dia.
Section 39 to 43 Main Bridge similar construction with exception blocks here 3"x3" 4" deep, and angles here omitted, and drain pipes here 15" dia.
2½"x12" plank on each stringer secured with ⅞" dia bolts 30" ctrs
3"x3"x6" Y.P. blocks
Concrete
15" drain pipe in every bucle pl
Stringers
2'-0"
Transverse Section
Floorbeams
3"x8" Creosoted Y.P. blocks 3" deep Laid on planks and concrete
Section 48 to 55 (south side) Main Bridge
Devised by E.A. BYRNE

Garbage and Refuse Collection and Disposal

IN ST. LOUIS, MO.

The city of St. Louis has been studying and discussing methods of collection and disposal of garbage and refuse for a number of years, but has not yet been able to put all the results of its studies in operation. This seems to be in part because of the reluctance of the city council to provide the funds for a complete system, and in part, perhaps, to considerable difference of opinion as to the best methods.

This article gives a brief statement of the present practice in collecting garbage and the results of a study of the motor tractor as a reducer of expense in making the long hauls necessary from some city districts under present conditions.

Collection of ashes and refuse at city expense was begun two or three years ago, but discontinued because the appropriations were stopped by the city council. A semi-annual clean-up week helps a little in keeping the city clean and at a low cost which the council is willing to meet. The results of these clean-up weeks are shown in the article.

THE collection of garbage and dead animals in St. Louis, Mo., is in charge of the assistant street commissioner, Charles L. Laxton, and is made from all public and private places within the city limits.

The department does not have full power to require proper receptacles in which garbage is to be held until the city wagons call for it, and consequently more than half the complaints regarding the service are due to the failure of the public to observe the rules governing the removal of garbage. Water-tight receptacles are recommended, of size to be handled by one man, and thoro washing after the garbage collector has emptied them is suggested. Drainage of the garbage and keeping lids on the cans, especially in cold weather, would keep the material from freezing enough to make it difficult to empty the cans.

For collection purposes the city is divided into two sections, in one of which garbage is collected Monday, Wednesday and Friday, and in the other on Tuesday, Thursday and Saturday.

At a recent meeting of the St. Louis Engineers' Club, C. M. Talbert, director of streets and sewers, gave the following statistics: The department owns 125 wagons and 459 horses, and has 120 men in its employment. The minimum number of wagons in use in winter, November to April, is 70 and the minimum daily collection is 80 tons. In summer, 115 wagons are in use on some days, and the maximum daily collection is 115 tons. The garbage wagons weigh 2,400 pounds, and the average weight of a load of garbage for the year is 1½ tons, or 3,000 pounds. In addition, the department removes about 12 large dead animals a day and perhaps 65 small animals and fowls.

At present all the garbage is hauled to two dumping stations at the river, making it impossible for a team from the western or southern part of the city to collect and carry to the dump more than one load a day. In the new contract for reduction of garbage is included the construction of two elevated dumping stations, so that the wagons will not be obliged to drive down to the garbage barges to unload, but can drive out and dump from the edge of the elevated platform into the barge and thus save climbing up and down the steep slope of the levee. Wagons will hereafter be lighter on account of the difference in dumping, and many of them will be one-horse carts instead of two-horse wagons. Mr. Laxton recommends four receiving stations instead of the two now in use, three being on the river and one in the western part of the city. With steel cars and properly designed dumping platforms, the cars can be filled during the day and hauled away at night. Lighter wagons and shorter hauls will largely reduce the cost of collection.

Some months ago computations were made, comparing the present cost of hauling garbage from the long-haul district with mule teams and the probable cost with tractors. The motor apparatus was assumed to be a Knox tractor with two trailers, and on the assumed haul of seven miles from Burd avenue and North Market to Mullanphy street this would replace ten teams.

The investment would be for 10-ton tractor, $3,750, and two trailers, $1,000, or a total of $4,750 for the motor apparatus. Ten teams of mules cost $3,000, and ten wagons cost $1,350, a total for animal power of $4,350.

The cost of operating per day is assumed to be for the motor making three trips a day, 42 miles:

Gasoline, 5 gallons, at 20 cents	$1.00
One-half gallon lubricating oil	.20
Chauffeur at $75 per month	2.50
Repairs, etc., 10 per cent	.37
Total	$4.07
Ten teams cost the city	$20.00
Ten drivers	16.50
Repairs, etc., at 2 per cent	.73
Total	$37.23

This computation assumes a loading station located at Burd avenue and North Market street, the center of the long-haul district, which, including lot, building, paving, platform, sewer and water connections, would cost $6,300. The total investment required for the installation of the motor equipment would, therefore, be $10,650. Interest on investments is computed at 6 per cent.

The total annual charges against the motor equipment would therefore become:

Interest	$ 639.00
Depreciation, 10 per cent. on truck and 2 per cent on building	561.00
Cost of maintenance, $4.07 for 156 days	634.92
Two men at dumping station	1,200.00
Making a total of	$3,034.92

The year is assumed at 156 days, as the district is collected from three times a week.

The charges against the team equipment are as follows:

Interest	$ 261.00
Depreciation, 10 per cent	435.00
Maintenance, 156 days, at $37.23	5,807.88
Total charges against team equipment	$6,503.88

The saving in adopting the truck system is thus $3,468.96 a year for this long-haul district. Under these assumptions the equipment is idle half the time, certainly enough to allow for time lost in repairs.

St. Louis had its first clean-up week in June, 1913, and followed it up with other clean-up weeks in May, 1914, and October, 1914, and this spring, from which no report is yet available. The number of loads of material hauled increased from 1,333 in June, 1913, and 1,415 in May, 1914, to 1,508 in October, 1914, and the cost per load has decreased from $2.02 in June, 1913, to $1.64 in May, 1914, and $1.48½ in October, 1914. The cost of clean-up week has remained very nearly the same, the highest cost being $2,695,40 for the first, $2,321.26 for the second and $2,239.44 for the third.

The city is divided into six districts, one for each day in the week, and tenants in these districts are notified in every possible way by the city and the local civic organizations of the day on which the collection for their district will be made. More than 250 loads a day were moved, or 1,508 tons, during the week, by an average of 66 teams at work all the time.

The number of complaints of poor service during clean-up week was 104, many of them because the material was not ready on the day assigned for the district from which the complaint came. About 15 teams worked for a week after the clean-up on such notices and collected about 100 loads of additional material.

City wagons from various sources were used largely in the clean-up, men and teams being hired as were necessary, and paid by the day. It is estimated that if payment had been made by the load, the average cost for making these special collections would have been reduced almost to $1.30 per load. Many of the wagons used belonged to the defunct ash division of the department, which purchased 80 wagons, each of 4 cubic yards capacity, and collected ashes for one year at a cost of 56 cents a cubic yard. On account of withdrawal of appropriations this work was stopped, and citizens pay for their own ash and refuse material, aside from garbage and the semi-annual clean-up week.

REGULATION OF JITNEY BUSSES IN ST. LOUIS

The regulation of the jitney bus has been undertaken with various purposes in the cities of the country. In some the intention seems to have been to legislate them out of business. License fees and bonds have been fixed so high that the traffic would not bear them and elimination was the result. In other cities the technical regulation of the jitney traffic has not been undertaken, sometimes because the ordinance makers admitted their inability to solve the problem, and sometimes because public opinion demanded the continuance of the service, and regulation was feared because it might drive the jitney out of business.

The Street and Sewer Department of St. Louis, with the co-operation of the Police Department, has undertaken the physical regulation of condition of autos, qualifications of drivers, permissible number of passengers, routes within certain congested districts, and has succeeded in keeping the traffic in operation and in reducing the liability of accident.

The problem of regulation of jitney busses is still under consideration, but few cities having taken any very definite steps in this direction. A few western cities have, by ordinance, required such heavy bonds of jitney runners to cover damage from accidents, that they have run them out of the business. Other cities regulate them under the ordinary police powers of the city.

The city of St. Louis takes care of them under a system devised by the Department of Streets and Sewers, which does not require the authorization of a special ordinance regulating jitney bus operation.

Each applicant, for authority to operate a jitney bus, takes his automobile to the city garage for examination and receives a certificate, of which the following is the blank form:

Registration No..... .....19..
Automobile.....make, manufacturer's carrying capacity.....
persons, bearing State License No.....has this day been examined and the following conditions found:
Service brake....., emergency brake....., clutch.....
Wheels....., springs....., axles....., steering gear.....
Rejected on account of.....
Accepted.....
Examined by.....
.....
Supt. City Garage.

He also receives a card, of which the following is a copy, which admits him to registration and which he also carries as evidence that his car has been examined and of the date of the last examination; he must show this card to the police on demand and must keep his car examination up to date.

The automobile, when approved by the city garage, is registered, when an application is filled in and presented at the office of the Director of Streets and Sewers. Following is the form of this application blank:

Examination of Jitney Car Service.

THE CITY OF ST. LOUIS,
Department of Streets and Sewers.
City Garage, Vandeventer Ave. and Forest Park Blvd.

.....
(Date)

This is to certify that.....automobile
(Name of Maker)
carrying State License No.....Manufacturer's rated carrying capacity.....persons, has this day been examined as to its general external conditions and no defects have been found which would indicate that it is unsafe to operate upon the public thorofares of the city in this service. This car, if retained in this service, is subject to further examination within two weeks of the date stamped herein.

.....
Supt. City Garage.

THE CITY OF ST. LOUIS,
Office of the Director of Streets and Sewers.
Registration No.....

Application is hereby made for the registration of the fol-

lowing described automobile to be used on the public thorofares of St. Louis, in what is commonly known as the "Jitney" service.

Make of car.....
Manufacturer's rated carrying capacity.....persons.
State License No.....
To be operated between.....and.....
General route to be followed.....

In consideration of this registration number being given by the city, it is agreed that the following regulations will be observed:

Number of Passengers—If car has a standard touring or limousine body, it shall at no time carry more than two additional persons in excess of the manufacturer's rating, as given in this application. This total number shall include the driver. If the car has other than above bodies, it shall not carry more persons than can be comfortably seated therein, and the total weight carried shall not exceed the weight the manufacturers state may be safely carried thereon.

Method of Seating—No persons shall be allowed on the car other than those entirely in the body thereof, and no persons shall be allowed to sit upon the doors.

Loading and Unloading—This car shall not, while on a public thorofare, receive or discharge passengers at any time other than when standing at the curb.

Racing—This car shall not pass another car for the purpose of securing a passenger.

Drivers—The driver or chauffeur will comply with Section 8510 of the Revised Statutes of Missouri 1909, which calls for state registration of auto drivers and will carry the badge upon his person. Drivers will at all times observe general traffic regulations and such special regulations as may be established for cars in this service.

Car Examination—This car shall be examined at least once every two weeks by an employe of the city at the city garage, Vandeventer avenue and Forest Park boulevard, as to its mechanical condition. The examiners shall make such tests as may be prescribed by the superintendent of the city garage. It is not intended that such examination shall amount to a thoro test covering latent defects or minute details. The examination shall be only for the purpose of ascertaining whether any visible or obvious reasons are disclosed why the car would be unsafe. If no such defects are found, the superintendent of the garage will issue a certificate of inspection and deliver to the owner.

Date.....
(Signature).....
(Address).....
.....

Approved:

.....
Directors of Streets and Sewers.

A card for conspicuous posting on the car is then issued as authority to run and statement of number of persons who can be carried at any one time. Following is the form of this card:

CITY OF ST. LOUIS.
Registry No.....
State License No.....
Allowed Capacity.....Persons.
(Including Driver.)

This registry number indicates that this car is operated under rules formulated by the City, covering Number of Passengers, Method of Seating, Loading and Unloading, Racing, State Registration of Drivers and Car Examination.

No charges are made for the examinations and permits, as there is no ordinance authorizing such charges.

No automobiles are permitted to stand for public hire at any place in the city unless they have filed an application for permit and permission from the owner or lessee of the property in front of which he proposes to stand, as shown in the following copy of the form of application, permission and permit. It will be noted that this form requires, also, the approval of the chief of police.

Permit No.....

OFFICE OF THE DIRECTOR OF STREETS AND SEWERS.
Room 322, City Hall.

APPLICATION FOR PERMIT TO STAND AUTOMOBILES FOR HIRE ON PUBLIC STREETS.

St. Louis.....1914.

Honorable Board of Public Service:

Gentlemen—Application is hereby made for permission to stand.....automobiles for public hire on..... side of.....(street) (avenue) between..... and.....in front of No.....between the hours of.....and..... Make of cars..... Capacity of cars.....passengers. Charges: $..... first hour, $.....each additional hour.

Name of driver of car.....

I (we) propose, if granted this permission, to be governed by the following conditions:

To use space designated in such manner as to give the public the best service consistent with the number of cars we operate.

To keep the cars clean and in a presentable condition and in first-class mechanical order.

That all drivers will be licensed and that both the police and the Department of Streets and Sewers will be notified when changes are made in the drivers or when the stand is discontinued.

That this permit is subject to revocation at any time the public interests demand it.

(Signed).....
St. Louis.....1914.

To Whom It May Concern:

This is to certify that the undersigned owner or lessee of abutting property has no objection to the issuance of permit set forth in above application.

(Signed).....
St. Louis.....1914.

The above mentioned driver of car approved.

(Signed).....
Chief of Police.
St. Louis.....1914.

The above application is granted under the provisions set forth for the period from.....191... to .....191...

.....
Director of Streets and Sewers.

The jitneys are, of course, required to obey all the general and special traffic regulations, of which there are many in some districts, routing traffic up one street and down another, designating parking spaces, protecting street car passengers in taking and leaving cars, etc.

The two photographs give some indication of the jitney traffic, one in a down-town street and one at an up-town center, where the automobiles are collecting their loads to go down town. These photographs, if they are typical of St. Louis conditions, indicate that the problem is not as serious in St. Louis as it is in some other cities, notably Los Angeles and San Francisco, where the streets are greatly overcrowded at the rush hours, and the jitney busses form a procession moving rapidly in both directions, with frequent interruptions by autos stopping to drop passengers.

STREET & SIDEWALK IMPROVEMENT IN THE UNITED STATES AND CANADA

THE following tables give the latest statistics regarding the construction of pavements in the United States and Canada. Practically all of the data are taken from blanks filled out by city engineers or men in the departments of public works and are as accurate as the differences in methods of keeping records and accounts permit, as all are reduced to a common basis of areas, lengths and costs per unit of length or area, as nearly as possible. Differences in definitions make some differences in classifications, so that it has been necessary in some cases to include a street under more than one classification because the information given was not sufficient to translate the definition in the mind of the city engineer into the terms of the standard definition used in making out the blank.

Bituminous pavements are those in which the variations in definition are greatest. The original asphalt pavement there can be no difference of opinion upon, but pavements on a concrete base with asphalt used in the wearing surface are of several varieties. Bitulithic is one, concerning which there can be no question. But the several variations, some using concrete base and some not, some using broken stone and some gravel, but all containing asphalt prepared in hot mixers, are classed by various engineers under "Concrete with Bituminous Top," "Bituminous Concrete," or "Bituminous Macadam," and unless full data regarding details of design and construction are given, it is impossible to re-classify exactly. Some streets are laid with concrete protected by a thin layer of asphaltic material on the surface, which are also classified as "Concrete with Bituminous Top."

By repeating a few cities in these various lists and by explanatory notes these differences have been reconciled as nearly as possible.

In the April number of MUNICIPAL ENGINEERING were given extensive tables showing the prospects for all kinds of municipal improvements for 1915. A column in each of the following tables is given to a statement of the prospective amounts of construction for 1915. Reference should be made to the April number, however, for there are numerous items in the April tables which are not included in these tables, because repetition has been avoided in order to save space.

These tables show, also, the amount of work done in 1914 and the most important items in the design and construction, including the cost per unit. As usual in statements of cost, there are many variations in the amounts of work included, so that the figures given can be compared only in the most general way.

It is common to include the entire cost of the pavement in the cost per square yard, from grading to finishing, but not to include the overhead charges of engineering, making and collecting of assessments, interest on bonds and the like, and most of the figures given are on this basis. The item of grading admits a possibility for considerable differences in cost, especially between hilly cities where cuts and fills are heavy, and level or gently rolling streets where grading means only excavation enough to make place for the new pavement.

In a few cases the cement, the brick or granite blocks or wood blocks are furnished by the city. These are noted where the cost does not include them.

But little change has been made in specifications during 1914. Those noted by the engineers include the following:

General Specifications.—LaPorte, Ind., has entirely rewritten its specifications to conform to the latest practice.

Imperial City, Cal., will use new specifications for next paving.

Newton, Kan., has made a number of elaborate changes.

Topeka, Kan., has made slight changes to get better control of materials.

Ann Arbor, Mich., has completely revised its specifications according to the best modern practice.

Saginaw, Mich., has reduced concrete base from 6 to 5 inches.

West New York, N. J., has reduced time of guaranty of pavements from 1 year to 6 months.

Okmulgee, Okla., has prepared a new set of specifications.

Xenia, O., includes asphalt, asphaltic concrete, brick, wood block, water-bound and tar-bound macadam.

Portland, Ore., has made a number of changes.

Charleroi, Pa., has entirely rewritten its specifications to conform with modern practice.

Philadelphia, Pa., has issued new standard specifications for all types of pavement.

Beloit, Wis., has issued new specifications.

West Allis, Wis., will make some changes in its new specifications.

Asphalt.—Des Moines, Iowa, has made asphalt specifications entirely open.

Olympia, Wash., specifies 4-inch concrete base and 2-inch asphalt top coat only.

Appleton, Wis., has reduced the thickness of asphalt wearing coat from 2 to 1½ inches.

Brick.—Pueblo, Col., has new specifications for this year's work.

Springfield, Ill., reduced the sand cushion from 2 inches to 1 inch in thickness, and will use prepared bituminous material in expansion joints instead of poured asphalt.

Richmond, Ind., reduces thickness of sand cushion from 2 to 1½ inches.

Des Moines, Ia., has reduced thickness of sand cushion from 2 inches to 1½ inches.

Emmetsburg, Ia., has its first specifications for its first pavement in 1915.

Oskaloosa, Ia., will put in more expansion joints when grout filler is used.

Dodge City, Kan., will use 2½-inch brick instead of 3-inch, and 4½-inch concrete base instead of 5-inch.

Ottawa, Kan., will use 3-inch vertical fiber brick with asphalt filler instead of repressed brick with grout filler.

Pittsburg, Kan., has made some changes in mixture for concrete base.

Salina, Kan., has lowered the rattler test for brick 2 per cent. and has admitted vertical fiber brick.

West Covington, Ky., will use "elastic" expansion joints.

Baltimore, Md., will use a mortar cushion instead of sand.

Flint, Mich., has reduced thickness of sand cushion from 2 inches to 1½ inches.

Sedalia, Mo., has adopted asphalt filler for all brick pavements and is using vertical fiber brick on residence streets.

Clyde, N. Y., has adopted the new New York State standard specifications.

Jamestown, N. Y., has omitted all transverse expansion joints.

Mt. Vernon, O., will use 1-inch sand cushion instead of 2 inches and wire-cut-lug brick instead of repressed brick.

(Continued on page 358.)

Street Improvements in the

Asphalt Pavements

City.	Proposed for 1915. Sq. Yds.	Laid in 1914. Sq. Yds.	Cost per Sq. Yd.	Thickness Surface	Thickness Binder
ALABAMA.					
Birmingham .	.....	37,655	$1.77	2	0
ARKANSAS.					
Little Rock...	.....	60,000	....	...	...
CALIFORNIA.					
Alhambra ...	30,000	.....	....	...	...
Berkeley	.....	9,881	....	...	...
Fresno	.....	53,000	1.50	2	1
Los Angeles..	825,000	824,223	1.00	1	1
Los Angeles..	.....	.....	1.60	2	1½
Oakland	.....	100,000	1.78	1½	2
Pasadena ...	.....	1,788	1.66	2	1
S. Bernardino	.....	72,423	1.98	2	1
S. Francisco..	300,000	200,074	2.19	2	1½
Santa Monica.	.....	12,816	2.07	2	1
So. Pasadena.	.....	42,500	1.41	2	1
So. Pasadena.	.....	7,700	1.23	2	0
Vallejo	.....	10,566	2.00	1½	0
Venice	.....	12,719	1.65	2	...
CONNECTICUT.					
Bridgeport ..	.....	3,205	2.01	1½	1½
Derby	2,000	19,600	2.15	1½	1½
Hartford	20,260	23,889	1.69	1½	1½
New Haven..	20,700	54,175	1.68	2	1½
DISTRICT OF COLUMBIA.					
Washington .	.....	28,282	1.69	1½	1½
FLORIDA.					
Sarasota	.....	9,500	1.25	2	...
GEORGIA.					
Cordele	.....	58,662	1.82	3	...
ILLINOIS.					
Aurora	16,000	48,483	1.73	1½	1½
Chicago	.....	816,623	1.53	1½	1
Chicago	.....	.....	1.68	2	1½
Oak Park....	2,659	43,667	1.42	1½	1½
Peoria	.....	6,657	1.65	1½	1
Rock Island..	.....	24,082	2.00	1½	1½
INDIANA.					
Elkhart	9,000	.....	....	...	...
Evansville ..	15,570	44,420	1.90	2	1
Ft. Wayne...	.....	56,478	1.75	1½	1
Gary	15,000	10,150	1.50	1½	1
Logansport ..	.....	26,470	1.95	1½	1
Newcastle ...	.....	5,557	1.80	2½	1
Portland	18,270	.....	....	...	...
South Bend..	.....	23,999	1.69	1½	½
IOWA.					
C. Rapids *d*..	70,000	15,130	1.95	2	...
Des Moines...	6,765	57,300	1.92	1½	1
Mason City..	85,000	37,200	1.60	1½	1
Waterloo	2,260	14,247	2.25	2	1
Waterloo	17,516	71,906	1.90	1½	1
KANSAS.					
Arkansas Cy..	9,000	.....	1.37	1½	...
Kansas City.	.....	5,850	1.70	...	...
KENTUCKY.					
Lexington ...	77,250	29,955	1.90	2	1
Louisville *d*..	50,000	97,275	1.74	2	1
Nicholasville	.....	48,000	2.17	...	...
LOUISIANA.					
New Orleans.	37,820	41,738	2.40	2	1½
MARYLAND.					
Baltimore ...	194,610	332,659	1.65	1½	1½
MASSACHUSETTS.					
Boston	.....	5,562	2.45	1½	1½
Holyoke	.....	17,227	1.70	2	...
Watertown ..	.....	7,306	1.15	...	...
MICHIGAN.					
Detroit	.....	21,698	3.14	2½	1
Detroit	.....	187,873	1.40	2	1½
Flint	92,783	25,191	2.85	1½	1
Grand Rapids	7,920	.....	1.30	2	1
Highland Pk.	35,000	45,486	1.63	1½	1
Saginaw	18,443	37,277	1.65	1½	1
MINNESOTA.					
Duluth	17,000	1,832	2.30	2	1½
Minneapolis .	15,000	15,704	1.49	2	...
St. Paul	10,000	23,657	1.16	2	1
MISSISSIPPI.					
Jackson *s*....	.....	12,625	.90	1½	p
Laurel	29,470	22,086	1.88	2	p
Vicksburg ...	.....	25,371	2.08	2	p
MISSOURI.					
Excelsior Sp..	6,000	.....	1.85	1½	1¼
Kansas City..	15,000	.....	1.80	2	1½
St. Louis ...	.....	27,850	1.90	1½	1½
NEBRASKA.					
Lincoln	10,000	7,712	1.88	1½	1½
Omaha	35,408	43,217	1.80	1½	1¼
Omaha	.....	4,927	1.62	2	1½

Brick Pavements

City.	Proposed in 1915. Sq. Yds.	Laid in 1914. Sq. Yds.	Cost per Sq. Yd.	Depth of Cushion.	Filler.
ALABAMA.					
Birmingham ..	.....	1,421	$1.99	...	*g-p*
ARKANSAS.					
Fort Smith....	.....	33,000	.82	3	*s*
Jonesboro	.....	10,000	1.96	2	*g*
Little Rock...	.....	5,000	....	...	..
CALIFORNIA.					
Los Angeles...	5,500	4,850	2.50	1½	..
Pasadena	.....	510	2.97	1½	*g*
San Francisco.	.....	2,262	2.53	1½	*g*
COLORADO.					
Pueblo	22,000	.....	2.50	1½	*a*
CONNECTICUT.					
Meriden	.....	2,135	2.55	1	*g*
Norwalk	1,700	1,836	2.15	2	*g*
DELAWARE.					
Wilmington ..	.....	5,600	....	2	*g*
DISTRICT OF COLUMBIA.					
Washington *c*.	.....	7,115	1.35	½	*g*
FLORIDA.					
Bradentown ..	.....	82,400	1.34	*s*	..
Gainesville ...	.....	2,500	1.71	...	..
Jacksonville ..	.....	19,337	2.08	...	*s*
Orlando	.....	43,900	1.35	...	*s*
GEORGIA.					
Savannah	.....	7,507	1.57	...	..
ILLINOIS.					
Alton	82,500	40,092	1.61	1½	*g*
Anna	.....	27,750	1.98	2	*g*
Aurora	2,100	3,854	1.88	2	*g*
Bloomington .	5,000	32,498	1.80	2	*g*
Champaign ..	.....	43,368	1.85	2	*a-s*
Chicago	.....	523,768	1.61	1½	*g*
Chicago Hgts..	45,000	57,000	2.12	2	*a*
Cicero	7,900	17,052	2.33	2	*p*
Danville	.....	44,174	1.70	2	*g*
Decatur	.....	7,261	1.77	2	*a*
Decatur	.....	29,062	1.66	2	*g*
Dixon	.....	57,915	1.64	2	*a*
Du Quoin.....	.....	16,576	1.80	1	*g*
E. St. Louis..	.....	21,487	2.21	2	*p*
Elgin	12,000	15,431	1.85	2	*g*
Farmer City..	.....	7,700	1.75	1½	*g*
Forest City...	.....	10,000	1.79	1½	*g*
Fulton	13,000	.....	2.10	2	*s*
Galesburg	20,742	51,372	1.81	1½	*a*
Herrin	9,560	24,862	2.02	2	*a*
Hillsboro	1,800	25,000	1.80	1½	*s*
Kankakee	.....	33,000	2.10	2	*g*
Kewanee	.....	600	1.75	1½	*a*
Lawrenceville	.....	13,892	1.84	2	*g*
Marion	.....	1,600	2.04	2	*a*
Mattoon	.....	6,000	1.58	1½	*g*
Moline	36,546	66,619	2.11	2	*a*
Mt Carmel....	.....	13,500	1.66	...	*g*
Murphysboro .	.....	12,000	2.02	2	*g*
Newton	6,635	.....	1.73	1½	*g*
Oak Park	18,526	12,000	2.07	2	*a*
Ottawa	.....	128,500	1.80	...	*g*
Pana	.....	34,000	1.67	2	*g*
Paris	3,450	6,750	1.80	1	*g*
Peoria	.....	63,838	1.47	2	*g*
Quincy	.....	41,627	1.99	1	*g*
Rockford	.....	58,818	1.90	1½	*a*
Rock Island...	.....	54,425	2.08	1½	*p*
Springfield ...	19,500	46,050	1.65	2	*a-g*
Spring Valley.	.....	5,083	2.05	2	*s*
Taylorville ...	.....	44,412	1.77	2	*a*
Venice	.....	18,008	2.00	1½	*g*
Waukegan ...	8,000	29,800	2.06	1½	*g*
Wilmette	.....	33,250	1.57	2	*s*
INDIANA.					
Bremen	15,985	.....	2.02	2	*g*
Crawfordsville	.....	10,266	1.32	2	*g*
Decatur	.....	18,015	1.20	2	*s*
Elkhart	15,000	1,082	1.95	1½	*g*
Evansville ...	8,300	12,102	1.78	1	*g*
Fort Wayne...	.....	66,550	1.76	2	*g*
Frankfort	4,590	5,764	1.68	1½	*g*
Gary	5560	22,540	2.15	2	*g*
Huntington ..	10,100	1,964	1.98	2	*a-g*
LaFayette	.....	7,155	1.76	2	*g*
LaPorte	10,000	12,394	2.19	1½	*g*
Lebanon	.....	10,608	1.70	2	*g*
Logansport ...	6,000	5,900	1.80	2	*g*
Muncie	.....	3,792	1.78	2	*g*
Noblesville ...	.....	4,804	1.33	2	*g*
Portland	.....	10,550	1.73	2	*g*
Richmond	40,000	20,620	1.85	1½	*g*
Salem	.....	4,383	2.32	...	..

Concrete Pavements

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	No. Courses.	Thickness.
ALABAMA.					
Birmingham .	.....	27,952	$1.28	2	7
Gadsden	.....	3,300	1.25	1	8
Opelika	.....	15,000	1.35	...	5
Selma	.....	41,500	1.25	1	5
ARIZONA.					
Flagstaff	12,000	6,677	....	...	...
Phoenix	.....	1,670	1.66	1	7
ARKANSAS.					
Argenta	.....	130,000	1.14	...	6
Fort Smith...	.....	91,650	1.25	1	6
Little Rock..	.....	50,000	....	...	...
Van Buren...	.....	1,400	....	...	...
CALIFORNIA.					
Los Angeles.	40,000	24,400	1.20	1-2	5-6
Palo Alto ...	.....	47,600	1.22	1	5
Pasadena ...	3,074	28,691	0.76	...	4
Santa Ana ..	7,500	192,500	1.00	1	4
So. Pasadena.	.....	3,284	1.44	1	8
Venice	.....	995	1.16	...	4
COLORADO.					
Boulder	.....	1,795	0.90	1	6
Denver	.....	2,000	1.40	...	7
CONNECTICUT.					
Ansonia	2,700	.....	1.20	1	6
Brantford ...	.....	70,400	....	...	...
Clinton	.....	4,000	....	...	...
Greenwich ..	.....	7,138	2.25	1	6-8
Hampden ...	.....	14,300	....	...	...
Hartford ...	14,000	.....	1.10	1	6-8
Manchester ..	.....	31,000	1.37	1	...
Meriden	.....	17,386	1.32	1	6
Middletown .	.....	8,800	1.33	1	6
New Britain.	.....	16,450	....	1	...
New London.	.....	8,750	....	...	...
Norwalk *a*...	3,900	9,000	1.25	1	7
Putnam *d*...	5,000	.....	....	...	...
So. Norwalk.	.....	9,000	1.24	...	7
Wallingford .	5,000	3,608	1.35	2	6½
W. Hartford.	.....	15,600	....	...	...
DELAWARE.					
Georgetown .	.....	700	1.37	1	...
Wilmington .	.....	15,000	....	2	6
DISTRICT OF COLUMBIA.					
Washington	21,000	18,000	0.94	1	...
FLORIDA.					
Fort Myers..	.....	1,500	....	...	...
Port Tampa *a*		13,052	1.50	2	5
Tampa	.....	1,300	....	...	...
GEORGIA.					
Athens	10,000	16,278	1.12	2	...
LaGrange ...	.....	20,000	....	...	...
Macon	150,000	17,292	1.36	1	8
Savannah ...	.....	3,300	....	...	...
IDAHO.					
Caldwell	.....	800	1.60	1	6
Kellogg	.....	9,000	....	...	...
Lewiston ...	.....	5,000	....	...	...
Moscow	.....	5,000	....	...	...
ILLINOIS.					
Bartonville ..	.....	8,000	1.08	...	6
Belleville ...	134,000	54,400	1.60	2	...
Bloomington .	.....	1,312	1.48	2	6
Champaign ..	.....	21,268	1.48	1	7
Charleston ..	.....	1,200	1.42	2	6
Chicago	.....	101,888	1.60	1	7
Chicago Hts..	20,000	.....	1.50	2	8
Dalton	.....	40,080	1.08	...	6½
Delevan	.....	32,300	1.19	1	6
Des Plaines..	.....	41,500	1.23	...	6
Dixon	.....	7,000	....	...	...
Eldorado ...	.....	5,300	1.20	...	7
Evanston ...	.....	2,400	1.60	1	6
Fulton	12,500	.....	1.40	1	7
Geneseo	.....	11,016	1.66	1	7
Glencoe	3,000	3,400	1.47	1	7
Highland Pk. *b*		17,200	1.07	...	6
Highwood ..	.....	9,100	1.22	...	7
Kankakee ..	.....	13,700	1.63	2	7½
Lyons	.....	12,200	1.54	2	6-8
Marion	.....	519	1.34	1	...
Marion	.....	.....	1.56	2	7
Moline	.....	10,199	1.10	1	7
Morgan Park.	.....	41,000	1.39	...	6¾
Morrison ...	.....	12,000	1.28	1	7
Morton Grove	.....	1,400	....	...	...
Mt. Carmel..	.....	8,195	1.20	2	7
Mt. Morris...	.....	1,900	....	...	...
Naperville ..	.....	5,500	1.40	2	6
Niles	.....	48,000	1.25	...	7
Park Ridge	.....	15,500	1.25	...	6
Peoria	4,000	2,394	0.94	1	6

United States and Canada

Concrete Pavements with Bituminous Top

See also "Bituminous Concrete" table items having concrete foundation.

City	Proposed for 1915	Constructed in 1914	Cost per Sq. yd.	Found. thick in.	Bit. Top thick in.
ARKANSAS.					
Pine Bluff	.....	12,000	1.00	...	...
CALIFORNIA.					
Imperial ...*a*	.....	58,522	2.66	5	*o*
Los Gatos	.....	43,174	1.26	4½	1½
Pasadena	10,114	31,109	1.62	...	...
Pomona	.....	4,127	0.93	5	⅝
San Bern'dino	.....	69,808	0.90	...	...
San Francisco	.....	81,259	....	...	...
Santa Ana	.....	19,800	0.99	4	1½
Santa Barb'ra	.....	64,418	1.48	4–8	1½
Santa Monica	.....	4,254	1.16	...	...
CONNECTICUT.					
Danbury	.....	31,400	1.75	...	...
Greenwich	.....	55,021	1.52	...	...
Hartford	.....	10,090	1.12	6–7	½
DISTRICT OF COLUMBIA.					
Washington	.....	14,674	0.94	6	...
FLORIDA.					
Bradentown	.....	22,810	1.43	4	1½
Jacksonville	.....	32,411	0.93	...	...
GEORGIA.					
Athens	.....	10,000	16,278	1.12	7	*t*
ILLINOIS.					
Chicago	.....	13,021	1.70	...	...
Marion	.....	12,511	1.25	...	...
Mt. Carmel	.....	14,400	1.00	...	...
Springfield	11,600	.....	1.37	4–6	2
INDIANA.					
Connersville	.....	2,000	....	...	...
Elkhart	14,690	15,812	1.49	5	2
Evansville	.....	9,433	1.40	6-8	...
IOWA.					
Cedar Falls	.....	7,200	1.40	5	2
Clinton	.....	1,380	1.45	...	...
Waterloo	.....	6,439	1.69	4	2
KANSAS.					
Abilene	.....	45,400	1.44	4½	2
LOUISIANA.					
New Orleans	.....	4,160	1.48	6	...
MAINE.					
Bangor	.....	5,988	....	...	...
Westbrook	.....	3,158	1.60	...	...
MASSACHUSETTS.					
Holyoke	.....	9,561	1.49	...	...
Somerville	.....	30,000	1.36	...	...
Springfield	.....	2,009	1.18	6	...
Worcester	.....	3,244	1.58	6	...
MICHIGAN.					
Ann Arbor	.....	11,832	1.25	7	¼
Highland Pk.	5,000	38,950	0.80	6	2
Ludington	.....	12,000	1.33	5	2
Manistee	.....	1,438	1.03	6	2
Petoskey	.....	9,831	1.50	4-6	1½-2
MINNESOTA.					
Duluth	.....	750	1.90	5	2
Rochester	29,120	18,520	1.54	5	2
MISSISSIPPI.					
Clarksdale	.....	2,400	1.83	5	1½
MISSOURI.					
Cape Girardeau	....	16,893	1.02	5	...
Chillicothe	.....	8,768	1.40	...	...
Columbia	.....	3,706	1.50	6	¼
NEBRASKA.					
S. Omaha	.....	20,178	1.86	...	...
NEW HAMPSHIRE.					
Laconia	1,200	1,200	1.65	4	2
Portsmouth	.....	15,000	2.31	...	...
NEW JERSEY.					
Irvington	.....	14,026	1.37	...	...
Ocean City	.....	9,000	1.17	6	¼
Roselle Park	.....	17,000	1.28	5-7	...
NEW MEXICO.					
Roswell	.....	17,553	2.02	...	...
NEW YORK.					
Binghamton	2,642	6,438	1.52	5-7	1
Jamestown	.....	12,329	1.36	5	2
Seneca Falls	.....	3,048	1.54	...	...
OHIO.					
Cleveland	.....	23,795	1.86	5	2
Geneva	.....	4,600	1.55	7	...
OKLAHOMA.					
Okmulgee	.....	6,832	1.70	4	2
OREGON.					
McMinnville	.....	73,503	1.52	4	2
Portland	.....	8,484	1.28	...	5
Salem	.....	12,487	1.26	4	1½
PENNSYLVANIA.					
Warren	.....	830	2.65	...	¼
TENNESSEE.					
Memphis	.....	14,599	1.32	6	¼

Bitulithic Pavements

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thickness, inches.	Foundation.
ALABAMA.					
Birmingham	.....	6,790	1.90	...	....
Montgomery	.....	12,914	....	...	....
New Decatur	.....	6,260	1.97	2	4*c*
ARIZONA.					
Phoenix	.....	18,490	2.13	...	....
Tucson	.....	59,195	...	...	....
ARKANSAS.					
Helena	.....	11,314	1.97	...	....
Little Rock	.....	75,000	...	...	....
Paragould	.....	36,705	...	...	....
CALIFORNIA.					
Berkeley	.....	43,800	...	...	....
Dinuba	.....	30,000	...	...	....
El Centro	.....	26,050	...	...	....
El Centro	.....	49,053	...	...	*w*
Lindsay	.....	57,587	...	...	....
Hermosa Beach	....	4,366	...	...	*w*
L. Angeles	86,310	33,000	1.80	1½	3–6*c*
L. Angeles	3,000	.....	...	...	*w*
Oroville	22,500	27,900	1.85	2	4*a*
Pasadena *b*	30,000	20,618	1.58	...	4*c*
Richmond	.....	34,587	1.79	5	2
Venice *w*	33,494	47,361	1.92	2	4
Wilmington	.....	47,854	...	...	....
COLORADO.					
Denver	.....	14,840	...	...	....
CONNECTICUT.					
Bridgeport	200,000	1,360	1.35	2	*w*
DELAWARE.					
Wilmington	.....	29,000	...	2	*c*
IDAHO.					
Lewiston	.....	55,859	...	...	....
Pocatello	.....	14,600	...	...	....
Wallace	.....	28,885	...	...	....
IOWA.					
Des Moines	.....	29,843	2.10	2	5
Pella	.....	36,194	2.06	2	5
Perry	44,000	.....	2.00	2	4
KANSAS.					
Kansas City	.....	12,051	...	...	....
Rosedale	.....	13,864	1.95	2	4*c*
KENTUCKY.					
Owensboro	.....	21,000	2.14	...	6*c*
Paris	.....	8,916	...	...	....
LOUISIANA.					
Alexandria	.....	14,920	2.20	...	....
New Orleans	50,300	14,370	2.40	2	6
MASSACHUSETTS.					
Boston	.....	54,842	2.50	2	6*c*
Brookline	10,500	11,230	1.61	...	....
Cambridge	4,350	22,453	2.75	2	5
N. Bedford *s*	.....	43,692	1.50	...	....
Springfield	.....	14,705	2.31	2	5
W. Springfield	.....	12,140	...	...	*w*
MICHIGAN.					
Grosse Pointe	.....	11,168	...	...	*w*
MINNESOTA.					
Aurora	.....	12,625	...	...	....
Buhl	.....	11,010	...	...	....
Hibbing	.....	8,556	...	...	....
MISSISSIPPI.					
Columbus	.....	11,000	...	...	....
MISSOURI.					
Maplewood	.....	4,725	...	...	....
St. Louis	.....	2,000	...	...	....
MONTANA.					
Billings	.....	35,000	11,872	1.98	...	....
Bozeman	....	40,000	29,001	1.97	2	4
Butte	.....	.....	21,761	2.85	2	5
Great Falls	9,200	77,530	2.00	2	4*c*
Lewiston	....	.....	55,859	...	...	....
Missoula	....	10,300	8,475	2.27	...	....
NEW HAMPSHIRE.					
Manchester	.....	8,000	...	...	....
NEW JERSEY.					
Bloomfield	..	2,000	16,000	2.23	2	6
Boonton *e*	...	.....	9,511	1.08	2	*s*
East Orange	.....	10,423	2.08	2	6*c*
Hoboken	....	.....	6,321	...	...	....
Kearney	....	.....	5,710	...	...	*w*
Newark	.....	20,000	136,953	2.25	2½	6
Woodbury	..	.....	9,791	...	...	....
NEW YORK.					
Auburn	.....	.....	8,946	2.33	2	6*c*
Batavia	.....	.....	3,100	...	...	....

Water-bound Macadam

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick Inches.	Foundation.
ARKANSAS.					
Ft. Smith	53,000	12,000	0.60	...	....
CALIFORNIA.					
Oxnard	.....	8,500	0.45	3	*r*
Richmond	.....	1,061	0.60	8	8
Riverside	.....	78,433	0.41	...	....
S. Bernardino	.....	261,986	0.86	...	....
Santa Monica	.....	186,032	...	...	....
CONNECTICUT.					
Danbury	.....	18,000	0.50	...	....
Hartford	3.05*m*	4.28*m*	0.61	8-10	...
Killingby	.....	5,760	...	7	*n*
Meriden	.....	5,578	0.33	...	....
New Britain	13,500	32,500	0.68	7	*t*
Rockville	.....	12,000	0.75	...	....
DISTRICT OF COLUMBIA.					
Washington	.....	58,182	0.73	...	....
FLORIDA.					
Bradentown	.....	5,400	0.65	6	*s*
Dade City	.....	140,000	1.40	4	....
ILLINOIS.					
Cicero	.....	22,900	1,549	1.20	...	....
Lyons	.....	.....	11,000	0.88	...	....
Quincy	.....	.....	50,375	...	...	....
Rockford	.....	.....	92,344	0.72	...	....
INDIANA.					
Gary	.....	60,000	42,580	0.90	3	7
Huntington	..	5,573	.....	0.71	9	*e*
Laporte	.....	.....	12,844	1.00	...	....
Lebanon	.....	.....	8,444	1.00	...	....
Muncie	.....	750	1,650	0.60	8–12	...
Richmond	...	5,000	23,000	0.40	5	*e–g*
Washington	.....	.....	12,286	...	...	....
IOWA.					
Dubuque	....	7,302	16,545	0.69	6	*a*
KANSAS.					
Chanute	.....	.....	3,100	0.58	...	....
KENTUCKY.					
Paducah	....	.....	1,104	0.36	...	....
MAINE.					
Augusta	....	.....	3,904	0.93	...	....
Westbrook	..	.....	2,600	1.00	...	....
MARYLAND.					
Frederick	...	.....	5,502	0.40	...	....
MASSACHUSETTS.					
Boston	.....	.....	1,199	0.75	6	*n*
Brookline	...	.....	100,000	0.45	...	....
Easthampton	.....	.....	8,000	1.33	...	....
Framingham	.....	.....	1,733	0.91	...	....
Greenfield	...	8,000	8,300	...	4	*o*
Lowell	.....	25,000	42,569	0.85	4–6	*n–o*
New Bedford	.....	.....	87,446	...	...	....
Peabody	....	16,000	20,860	0.25	5*	....
Revere	.....	12,000	4,000	0.70	4–6	*g*
Southbridge	.....	.....	4,200	0.72	...	....
Springfield	..	.....	6,523	0.57	6	*s*
Waltham	....	.....	13,356	...	...	....
Watertown	..	.....	3,653	0.55	...	....
Webster	....	.....	3,839	0.75	...	....
Westfield	....	.....	2,894	0.83	...	6
Woburn	.....	.....	3,800	0.63	...	....
MICHIGAN.					
Menominee	..	3,000	7,373	0.67	9	*s*
Negaunee	...	.....	18,000	0.49	...	....
Norway	.....	.....	15,000	0.40	9	*s*
MINNESOTA.					
Stillwater	...	.....	11,000	...	...	....
MISSISSIPPI.					
Jackson	.....	.....	8,000	0.35	...	....
MISSOURI.					
Columbia	....	.....	1,633	1.04	8	6
Excelsior Spgs.	2,600	.....	1.20	4	8*t*
St. Louis	.....	.....	100,000	...	...	....
MONTANA.					
Dillon	.....	45,000	4,800	...	10	*n*
Great Falls	..	.....	4,750	0.35	...	....
NEW HAMPSHIRE.					
Berlin	.....	.....	4,738	0.73	...	....
NEW JERSEY.					
Boonton	....	.....	5,000	...	6	*n*
Hackensack	.	.....	3,600	0.56	...	....
Montclair *b*	.....	1,700	0.93	3	5*t*
Morristown	.	.....	6,400	0.66	...	....
Plainfield	...	.....	17,900	0.57	6	....
Ridgewood	..	8,200	13,000	0.40	4	*g*
Rutherford	..	20,000	23,750	0.66	6	3
Summit	.....	4,000	3,500	0.65	6½	*t*
Trenton	.....	.....	12,979	0.78	6	....
Westfield	...	20,000	32,000	0.52	...	....
W. N. York	..	.....	4,930	...	...	....
W. Orange	..	.....	1,400	0.59	...	....
NEW YORK.					
Auburn	.....	36,000	36,000	0.70	5	*o*
Glens Falls	..	.....	2,000	...	...	....
Hudson	.....	.....	5,000	0.45	...	....
Kingston	....	.....	17,900	0.18	...	....

Asphalt Pavements (cont.)

NEW JERSEY.					
Atlantic City.	7,575	150,570	1.77	1½	1½
Bayonne	94,300	163,336	1.84	1½	1
Camden		34,754	1.90	2	1
Jersey City		3,251	2.28	2	1½
Newark	30,000	11,947	2.04	2	1½
Passaic	104,000	14,547	1.71	1½	1½
Ventnor Cy		1,200	1.73	1½	1½
NEW YORK.					
Albany		80,560	2.11	2	1
Buffalo		74,600	3.53	2	1½
Buffalo *r*		136,376	3.26	2	1½
New York City—					
Bronx Boro.		71,628	1.87	...	...
Br'k'n Boro.	500,000	337,085	1.64	2	1
Manh. Boro.		182,676	1.82	2	1
Queens Boro		66,665	1.85	2	1
Poughkeepsie		7,350	2.44	2	1
Rochester		96,466	1.80	2	1
Schenectady	40,000	7,286	2.00	2	1
Syracuse	100,000	62,800	1.87	2	1
Troy		17,238	2.45	2	1
NORTH CAROLINA.					
Charlotte		40,000	1.54	2	1
Greensboro	12,750		1.50	1½	1½
Raleigh		24,365	1.70	1½	1
Rocky Mount		45,420	1.58	1½	1½
OHIO.					
Amherst		11,050	1.60	2	...
Canton		13,709	1.73	1½	1
Cincinnati	29,680	15,850	2.53	1½	1½
Columbus		130,187	2.00	2	1
Conneaut *d*	15,000				
Galion	37,000			1½	1
Hamilton	17,000	15,000	1.90	1½	1
Lorain		27,453	1.60	1½	1
Marion	4,000		2.02	2	1
Middletown	38,611	21,390	2.00	1½	1½
Sandusky		23,397	1.80	1¾	1
Springfield		20,100	1.95	2	1
Toledo		58,054	1.98	2	1
Urbana		4,200	2.10	2	1
OKLAHOMA.					
Shawnee		16,000	1.90	1½	1
Tulsa	40,000	53,400	1.49	2	...
OREGON.					
Eugene	14,410		1.48	2	1
Portland	5,000	40,447	1.54	2	1
PENNSYLVANIA.					
Chester		46,000	1.75	2	1½
Dunmore		2,475	2.19	2	1
Erie	50,000	96,579	1.53	1½	1½
Harrisburg	30,000	58,009	1.90	2	1
Johnstown		29,435	2.05	2	1
Larksville		17,000	2.28	...	...
Philadelphia		363,914	1.84	2	1
Pittsburgh	15,000	55,000	2.35	1½	1½
Scranton		29,610	1.96	2	1
Wilkesbarre	41,000	43,887	2.00	2	1½
RHODE ISLAND.					
Pawtucket		1,276			
Providence	28,095	24,909	2.43	2	1
SOUTH CAROLINA.					
Charleston		26,360	1.65	1½	1½
Columbia	49,400		1.64	1	1½
Greenville	15,000		1.55	2	1
TENNESSEE.					
Johnson Cy	30,000	16,044	2.00	2	1
Memphis		18,854	2.01	2	1
TEXAS.					
Dallas		24,326	1.98	2	...
Hillsboro		38,000			
Houston	7,637	81,881		2½	...
UTAH.					
Ogden	12,550	54,418	2.10	1½	1½
Salt Lake Cy.	34,700	281,542	1.79	2	1½
WASHINGTON.					
Aberdeen	20,000	11,531	1.68	2	1
Bellingham	50,283	46,139	1.45	2	1
Everett	40,000	37,114	1.45	2	1
Olympia	24,364	25,181	1.30	1½	1
Seattle	105,000	217,685	1.40	2	1
Tacoma		33,981	2.01	1½	1
WISCONSIN.					
Appleton	23,000		1.89	1½	1
Beloit	50,000		1.37	1½	1
Green Bay		51,373	1.89	1½	1
Madison		29,904	1.80	2	1
Milwaukee	250,000	296,826	1.88	1	2
Racine		9,055	2.03	2	1
Superior		54,629	1.74	1½	1
West Allis	23,000			2	1
CANADA.					
Edmonton		4,654	2.45	2	1
Vancouver		1,350	2.47	2	1
Victoria		112,301	1.97	2	1
Kingston		7,999	2.35	2	¾
London	65,400	43,260	2.36	2	1
Ottawa		120,000	2.20	2	¾
Toronto *b*		316,694	1.23	2	1½
Westmount		4,514	3.18	2	1
Regina	*o*	25,755	2.85	2	1

b—without base.
d—total prospective paving—kinds not yet decided.
p—paint coat.
s—asphalt surface on old brick pavement.
r—repaving, constructing new base.

Brick Pavements (cont.)

South Bend		10,116	1.51	1½	*s*
Vincennes	45,000	10,457	1.82	1½	*g*
IOWA.					
Anamosa		20,000	2.00	...	*a*
Belle Plaine		1,200	2.14	1½	*a*
Burlington	5,500	691	1.60	2	*s*
Cedar Rapids	42,500		1.98	2	*a*
Clinton	12,230	2,695	2.00	1½	*a*
Council Bluffs	4,423	1,750	2.26	5	*a*
Davenport		23,000	1.80	...	*p*
Des Moines		13,130	1.76	2	*g*
Dubuque	22,069	41,416	1.86	2	*a*
Emmettsburg	41,000		1.97	2	*g*
Fort Dodge		18,000	2.15	1	*s*
Fort Madison	34,000*d*	4,499	1.62	2	*s*
Marshalltown		2,527	1.70	2	*a*
Missouri Valley		25,000	1.93	1½	*a*
Muscatine		1,246		1½	*g*
Oskaloosa		17,072	2.05	1½	*g*
Pella	Some.				
Sioux City		5,627	1.85	1	*g*
Waterloo					
KANSAS.					
Arkansas City	12,000			1½	*a*
Atchison	5,500	6,000	1.75	1	*s*
Chanute	15,000*d*	11,000	1.51	1½	*a*
Dodge City	15,000	25,500	1.63	1½	*a*
Emporia		10,000	1.75	1	*g*
Fort Scott	35,000	6,700	1.63	1½	*a*
Herington	10,000		1.85	1½	*a*
Hutchinson		20,000	1.70	1¾	*a*
Independence	9,000	8,533	1.30	1½	*a*
Iola		640	1.65	1	*a*
Kansas City		19,146	1.82	...	..
Neodesha	25,000	23,000	1.43	1½	*a*
Newton	25,000	5,000	1.85	2	*a*
Ottawa	22,400	10,157	1.55	2	*g*
Pittsburg	40,000*d*	71,896	1.45	1½	*s*
Rosedale		4,356	1.85	1½	*a*
Salina	30,000	13,000	1.76	1½	*a*
Topeka	29,400	23,405	1.50	1½	*a*
KENTUCKY.					
Lexington		4,167	2.25	1	*g*
Louisville	60,000*d*	82,962	1.78	1½	*g*
Morganfield	6,000	8,000	2.05	2	*s*
W. Covington	16,000		1.24	1½	*g*
LOUISIANA.					
Lake Charles	15,000	50,000	1.96	2	*a*
Shreveport	2,000	303	2.35	2	*p*
MARYLAND.					
Baltimore	67,230	102,772	2.20	...	*g*
MASSACHUSETTS.					
Cambridge		2,950	3.75	1	*g*
Greenfield		2,900	2.34	2	*g*
Walden		2,230	2.55	1	*g*
Norwood	10,000			1½	*a-g*
Pittsfield		1,130	2.90	1½	*g*
Somerville		3,000	2.63	1	*g*
MICHIGAN.					
Ann Arbor		2,350	1.75	1½	*g*
Battle Creek	5,000	51,194	1.67	1¾	*g*
Benton Harbor	37,000	6,000	1.60	1½	*s*
Detroit		33,365	3.13	1	*g*
Flint	27,441	46,232	2.52	2	*g*
Grand Rapids	55,800	42,100	1.25	1½	*g*
Kalamazoo	19,583	4,784	1.98	1½	*p*
Menominee	770		2.17	2	*g*
Niles		10,000	1.68	2	*a*
Port Huron	4,000				
Sturgis	20,000	20,506		1½	*a*
MINNESOTA.					
Duluth	55,000	64,642	2.25	2	*g*
Mankato	12,000			2	*g*
Minneapolis	10,000	11,018	2.12	1	*a*
Red Wing		619	1.62	2	*p*
St Paul	7,000	17,748	2.48	1½	*a*
Winona	33,540	9,423	1.48	2	*s*
MISSISSIPPI.					
Vicksburg		27,739	2.25	1½	*g*
MISSOURI.					
Brookfield		1,760	1.40	3	*g*
Chillicothe		8,768	1.76	...	*s*
Jefferson City		875	2.00	2	*a*
Kansas City *b*	75,000	45,282	2.03	1	*a*
Mexico		4,225	1.67	2	*s*
St. Charles		3,087	1.85	...	*g*
St. Louis		130,000	1.82	1	*g*
Sedalia	30,000		1.35	1½	*a*
Sikeston		12,500	2.24	1½	*a*
University Cy.	5,900	11,346	1.85	1	*g*
Warrensburg	1,564	7,328	1.98	1½	*a*
NEBRASKA.					
Auburn		11,500	2.10	1½	*a*
Grand Island	20,000	11,000	2.10	1½	*a*
Hastings		679	1.87	1½	*g*
Havelock		9,000	2.12	1½	*a*
Lincoln	20,000	15,221	2.30	2	*a-g*
Omaha	34,818	17,562	2.10	1½	*p*
Seward	Some	25,000	2.19	1½	*a*
So. Omaha	20,450	58,708	2.02	1½	*s*
York	50,000		1.84	1½	*a*
NEW JERSEY.					
Atlantic City		14,690	2.60	1½	*g*

Concrete Pavements (cont.)

Princeton		3,800	1.22	...	6½
Prophetstown		3,600	1.23	2	...
Riverdale		5,300	0.89	...	7
Riverside		600			
Robinson	8,000		1.35	1	7
Rockford		5,670	1.13	1	6
Sheridan		800			
Springfield		550	1.50	2	5
Summit *b*		31,200	0.70	...	7
Taylorville *a*		3,648	1.38	2	6
Wilmette		3,627	1.15	1	6-8
Winnetka		6,500	1.40	1	7
Woodstock		44,400	1.13	...	6½
INDIANA.					
Albion		4,300	1.35	...	7
Ambia		6,670	1.44	1	7
Anderson	104,668	22,702	1.35	1-2	6-8
Bluffton		4,200	1.59	...	8½
Connersville		5,000	1.02	1	...
Connersville			1.35	2	...
Elkhart		972	1.43	1	6
Evansville		7,270	1.52	1	6
Ft. Wayne	1,500	3,816	1.45	2	7
Frankfort	9,100	14,488	1.25	2	6-8
Gary		12,000	1.32	1	7
Gary			1.70	2	7½
Hammond		4,000			
Huntington		1,111	0.90	1	6
Indianapolis		4,100	1.58	...	8
Knightstown		32,100	1.15	...	7
Lafayette	45,000	5,300	1.32	1	6-8
Laporte	1,500	500	1.49	1	7
Logansport	6,000	7,900	1.45	1	7
Michigan Cy.		3,000	1.53	1	...
Newcastle		1,210	1.40	1	7
Osgood		1,800	1.26	...	6
Richmond	8,000	5,747	1.54	1	8
Richmond		8,790	1.12	2	6½
Roanoke		3,300	1.37	...	7
Rochester		3,400	1.10	2	6
Rushville		2,500	1.30	2	6
Seymour		20,215	1.37	2	7
South Bend		6,153	1.43	1	7
Sullivan	1,715	2,600	1.25	2	...
Terre Haute		26,900			
Washington		1,144	1.20	2	7
IOWA.					
Algona		2,532	1.24	1	6
Atlantic		51,927	1.18	1	6
Belle Plaine	32,000		1.35	2	6
Bloomfield		10,300	1.46	...	7
Burlington		3,100	1.20	...	6
Cedar Rapids	5,000	30,500	1.30	2	7
Clarinda		38,000	1.37	...	6
Clinton		1,379	1.45	1	...
Council Bluffs	64,262	18,617	1.38	1	6-7
Cresco		22,500	1.33	...	6
Davenport	10,000	4,581	1.00	1	...
Des Moines		65,364	1.50	1	6-8
Dubuque		2,390	1.30	1	7
Eagle Grove	53,000	4,241	1.51	1	7
Forest City	1,000		1.24	1	6
Ft. Madison	1,000	992	1.12	2	7
Indianola		56,047	1.20	1	6
Keokuk	12,000	7,000	1.10	1	...
Marshalltown	30,000	5,987	1.30	2	7
Mason City	35,000	150	1.23	2	...
Monticello		22,248	1.35	1	6
Nevada		21,000	1.51	...	7
Newton		3,000			
Sac City		5,400			
Sheldon		14,500	1.22	...	6
Sigourney		10,001			
Sioux City	250,000	156,373	1.22	1	6
Storm Lake	51,920		1.33	1	5
Vinton		9,800	1.40	...	7
Washington		22,000			
KANSAS.					
Abilene		5,000	1.10	1	6
Atchison	2,000	2,500	1.15	2	6
Fredonia		2,000			
Iola		8,450	1.13	2	6
Kansas City		43,282	1.03	...	
Manhattan		1,250	2,673	1.00	2
Newton	15,000	5,000	0.84	1	6
Pittsburg	540	5,839	1.05	1	6
Salina		1,025	1.25	1	6
KENTUCKY.					
Louisville		5,269	1.45	1	6
Pikeville	105		5.40	2	8
LOUISIANA.					
New Orleans		3,490	2.33	2	8
MAINE.					
Biddeford	30,000	23,000	1.65	...	...
Portland	5,000	7,164	1.65	...	6
S. Portland		12,884	1.31	1	6
MARYLAND.					
Baltimore	7,700	9,696	1.17	...	6
Elk Ridge		2,600	1.20	...	5-8
MASSACHUSETTS.					
Adams		14,000			
Fall River		3,558	2.12	1	6
Lynn		67,595	1.16	1	6
Revere	100		1.50	...	...

Concrete, Bit. Top (cont.)

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick inches.	Foundation.
TEXAS.					
Austin		1,227			
Dallas		5,902	1.75	6	¼
Denison		26,731	1.64	5	2
Hillsboro		600	1.50		
Waxahachie		6,342	1.80		
WASHINGTON.					
Aberdeen		5,197	1.16	4-6	2
Spokane		32,298	1.10		
WEST VIRGINIA.					
Charleston		2,820	1.31		
Oshkosh		20,886	1.63	5	2
CANADA.					
Toronto		3,240	1.65	6	
Windsor		1,190			

a—Reinforced concrete.
b—Concrete surface oiled with 90 per cent. asphalt.
t—Tarvia A and sand surface finish.
v—Vibrolithic.

Bituminous Macadam

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick inches.	Foundation.
ALABAMA.					
Gadsden		2,500	1.40		
ARKANSAS.					
Ft. Smith		7,000	0.75		
CALIFORNIA.					
Alhambra		46,344	0.66	4½	
Berkeley		17,400			
El Centro		49,053			*w*
Hermosa Beach		4,366			*w*
Hollister		32,805	0.88	6	
Los Angeles		6,300	1.00	6	*s*
Manhattan Beach		56,510			*w*
Oxnard		8,500	0.45	3	*r*
Pasadena	88,624	43,374	0.72	4-7	
Redondo Beach		6,979			
Riverside		4,464			
S. Francisco	230,000	35,444			
S. Pasadena		3,000	0.27	2	
Vallejo		12,130			
Venice		15,480	0.68	4	
CONNECTICUT.					
Danbury	35,000	30,000	0.95		
New Haven		105,383	0.63	2	4
Putnam		10,000	0.80	4	3
Wallingford		13,290	1.17	7½	
DELAWARE.					
Wilmington		43,000		2	*e*
DISTRICT OF COLUMBIA.					
Washington		4,500			
GEORGIA.					
Atlanta		85,311			
ILLINOIS.					
Chicago		580,594	1.23	10½	
Elgin		42,852	1.25		
Hinsdale		9,000	1.32		
Murphysboro		41,000	1.25	2½	4*c*
Quincy		31,175	1.49		
INDIANA.					
Decatur		3,576	0.67	3	6
Greencastle	80,000		0.85	2½	8
Laporte tp.		5,018	1.13		
South Bend		1,791	0.98	8	
IOWA.					
Dubuque	9,302	16,545	0.69	6	*s*
KANSAS.					
Atchison		13,000	0.72	9	*r*
Kansas City		2,430	1.29		
Osawatomie		15,735	0.90	9	
Ottawa		21,062	0.92	3	*s*
Wellington		250	0.90		
MAINE.					
Gardiner		2,800			
Portland	Some	7,033	1.08		
MASSACHUSETTS.					
Belmont		15,000	1.00	6	
Boston	Some	85,807	1.00	6	*n*
Brookline	30,000	40,000	0.63		
Cambridge		30,785	1.25		
Clinton		10,792	0.50		
Everett		30,783	1.33		
Fall River		30,778	1.19		
Framingham		1,582	1.11		
Haverhill	34,070	36,884	1.10	6	
Lowell	50,000	28,757	0.95	4-5	*g–m*
Medford		10,767	1.37		
Newton		71,000	0.56	3	
Norwood	50,000			3	*t*
Peabody	2,775		0.70	6	
Revere	10,000	8,000	1.05	4	*g*
Somerville		60,000	0.88		
Southbridge		8,400	1.12	6	10*s*
Springfield		143,747	1.06	2	*m*
Stoughton		3,550	0.80		
Waltham		9,864	0.66		
Watertown		10,306	0.55		

Bitulithic (cont.)

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick inches.	Foundation.
Binghamton		2,027	2.36	2	6
Frankfort		927			
Hempstead		8,584			*w*
Herkimer	12,000	2,224	2.18		
Ilion		17,500	2.18		
Johnstown		11,799	2.45	2	6
Little Falls		9,600	2.28		
Lowville		327			
Mohawk		145			
New York City— Queens Boro.		92,730	1.65	2	5
New Rochelle		8,819			
Oriskany Falls		11,219			
Saratoga Spgs.		6,785	1.60		
Troy		28,409	2.61		
Utica	40,000	30,496	2.26	3	6
Yonkers		24,847			
NORTH CAROLINA.					
Asheville		45,400	2.10	2	5
Hendersonville		30,550			
Rockingham		9,359			
Wilmington		18,000			
OHIO.					
Norwood	18,000	21,000	1.75	2	6*c*
OKLAHOMA.					
Bartlesville	10,000	3,780	2.15	2	4*c*
OREGON.					
Eugene	16,000	29,050	1.78	2	6
Forest Grove		11,684			
Marshfield		16,500	2.10	2	6
North Bend		10,524			
Pendleton		35,515			
Portland	32,000	33,041	1.85	*s*	6
Seaside		28,046			
Sheridan		3,657			
PENNSYLVANIA.					
Hanover *w*	35,500	16,000	2.05	2	6
Scranton		6,721	2.39	3	6
Lansdowne	8,000		1.20	3	*e*
York		11,829			
Marcus Hook		13,815			*w*
RHODE ISLAND.					
Pawtucket *w*		6,472		2	4
Providence	18,375	77,495	2.26	2	5
TENNESSEE.					
Jackson		3,428	2.17	2	6
Jackson *g*		4,557	1.75		8
Nashville	50,000	118,000	1.70	2	6
Nashville *f*	35,000		1.55		5½
TEXAS.					
Austin	7,705	42,087	2.16	2	5
Corpus Christi		78,068			
Dallas		86,983	2.30	2	5
El Paso		66,762			
Ft. Worth		143,715			
Houston		91,050	2.48	2-2½	5-6
San Antonio		109,692			
Waco		70,017			
UTAH.					
Salt Lake	30,000	93,000	1.93	6	*h*
VIRGINIA.					
Richmond		29,800			
WASHINGTON.					
Olympia		3,658	1.08	1½	4½
Pullman		36,202			
Sumner		6,720			*w*
Walla Walla	17,600	11,440	1.48	1½	2½*a*
WEST VIRGINIA.					
Charleston		17,055			
Edgewood		25,500			*w*
Sheridan	74,000	21,046	2.12	2	5
CANADA.					
Edmonton		5,737	2.70	2	6
Nanaimo		98,419			
N. Westminster		22,051	2.25		
Point Grey		12,350			
Revelstoke		18,143			
Saanich		23,160			
S. Vancouver		10,594	2.45	2	5
Vancouver		7,369	1.35		
St. Boniface		10,207	2.70	2	6
New Glasgow		4,958			
Berlin		12,086	2.53	2	5
Chatham		796	2.31	2	5
Galt		3,780			
St. Catherines		12,127			
Sault Ste Marie		20,180			
Sudbury		29,284	1.65	2	6
Toronto		47,629	1.55	2	5
Waterloo		15,090			
Lachine		22,896			
Montreal		95,208			
St. Lambert		6,001	2.81	2	5
Regina		28,349	3.00	2	5
Saskatoon		4,900			

a—Asphaltic concrete.
b—Included in "Concrete, bituminous top," table also.
c—Concrete.
e—Amiesite.
f—Bitustone.
g—On gravel macadam.
h—On bituminous macadam base.
s—Crushed stone base.
w—Warrenite.

Water-bound Macadam (cont.)

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick inches.	Foundation.
Little Falls		3,000	1.00		
Mamaroneck		1,108	0.80		
Middletown		15,000	0.50		
New York— Queens		99,320			
Ogdensburg		22,909			
Saratoga Spgs.		14,660			
Solvay		5,460	0.65		
Watertown		30,000	0.55		
NORTH CAROLINA.					
Charlotte		17,000	0.50	6	
Raleigh		94,812			
OHIO.					
Ada		9,360	0.77	6-9	*e*
Bellefontaine	1,300		0.58	8	
Cincinnati	11,870	2,217	1.29		
Fostoria		2,831	0.58		
Greenville	6,200	5,085	0.60	8	
Marion		10,747	0.50	8–12	*e*
Middletown		9,473	1.36	2½	6*c*
Norwood	15,000	3,000	0.56	9	*n*
OREGON.					
Eugene		5,900	0.70	1	5
Portland	100,000	32,258	0.46	6–8	*n*
PENNSYLVANIA.					
Bethlehem		6,609	1.77		
Coatesville	8,825				*r*
Columbia		4,000	0.28		
Hazleton		38,607	0.35		
Lansdowne	800	15,000	0.80	6	*t*
Philadelphia	Much	95,952	1.08	3–4	*a–t*
Pottsville		30,217	0.37		
Waynesboro		4,000	0.42		
Wilkes-Barre	1,100			17	8
RHODE ISLAND.					
Pawtucket		0.42*m*			
Providence	48,106	69,600	0.63	6	
Westerly		2*m*	0.65		
SOUTH DAKOTA.					
Lead		6,000			
TENNESSEE.					
Clarksville		34,700	0.14		
TEXAS.					
Dallas		3,640		8	
Houston		12,841			
Longview		7,790	0.94	9	7
VERMONT.					
Rutland		2,425	0.45	6	
VIRGINIA.					
Bristol		15,000	0.30		
Newport News		7,036			
WASHINGTON.					
Kent		8,573	0.85	6	
N. Yakima		2,970	0.48		
Sunnyside		10,000	0.27	4½–8	*n*
WISCONSIN.					
Baraboo		8,000	0.65		
Green Bay	6,000	1,278	1.24	9	
Janesville		6,849	0.51		
Madison		2,669	1.00	8	*t*
Marinette		2,401	0.70		
Milwaukee	15,000	33,022	1.05	8½	6
Oconto		3,200	0.75		
Waupaca		3,600	0.36	5–8	*n*
WYOMING.					
Cheyenne		17,335	0.27	3½	*n*
CANADA.					
Vancouver		16,701	0.80		
Brantford		15,000	0.50		
Kingston		12,475	0.40		

a—Crushed stone base.
b—Clay-bound macadam.
c—Concrete base.
e—Clay base.
g—Gravel base.
m—Miles in length.
n—Natural soil base.
o—Old macadam base.
r—Resurfacing.
s—Sand base.
t—Telford base.

Oiled Roads and Streets

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	No. of Oilings.	Notes.
ARKANSAS.					
De Queen	80m	60m	0.04	3	*g*
CALIFORNIA.					
Covina	120,000	277,970	0.082		*s*
Covina		3,020	0.032	1	*g*
Hollister	18,326	28,394	0.90		
Huntington Beach	39,700		0.90		*m*
Huntington Beach	9,000		0.72		*p*
Imperial		58,522		1	*a*
L. Angeles	350,000	353,334	0.65	3	*g*
Monrovia	24,000	11,000	0.25	2	*at*
Orange	Some	45,000		1	
Pasadena	13,444	86,929	0.396		

Asphalt Block

City.	Proposed for 1915, Sq. Yds.	Constructed in 1914, Sq. Yds.	Cost Sq. Yd.	Size, in.
DISTRICT OF COLUMBIA.				
Washington		8,092	$1.78	5
GEORGIA.				
Savannah		17,545	1.90	
MASSACHUSETTS.				
Holyoke		5,567	2.30	2
MICHIGAN.				
Flint	1,960		3.16	12x5x2
NEW JERSEY.				
Newark	25,000	10,817	2.53	12x5x 2-2½
W. New York		26,650	2.25	12x5x2
NEW YORK.				
Albany		3,238	2.35	10-12x 4-6x2
Jamestown		9,423	2.30	12x5x3
Lockport		20,972	2.25	
New York—				
Bronx		1,650	2.47	
Manhattan		4,502		
Queens		8,923	1.75	
Niagara Falls		34,000	2.64	11x5x3
OHIO.				
Fostoria		12,279	1.83	
London		12,179	2.15	5
Marion	7,000	12,219	2.06	12x5x2½
Tiffin		5,100	1.90	
Toledo		7,794	1.75	12x5x2½
TEXAS.				
Houston		72,038		
WASHINGTON.				
Seattle		52,500		
CANADA.				
Victoria, B. C.		56,951		
Windsor, Ont.		32,578	2.75	
Quebec, Que.		4,586		
Regina, Sask.		28,525	3.00	5

Creosoted Wood Block

City.	Proposed in 1915.	Laid in 1914. Sq. Yds.	Cost per Sq. Yd.	Lbs. Preservative.	Sp. Gr.
CONNECTICUT.					
Ansonia		9,500	$3.32	20	1.10
Bridgeport		9,970	3.14	16	
Meriden	9,240	44,331	3.20		1.08
New Haven		81,944	3.00	20	to 1.14
FLORIDA.					
Pensacola		1,600	2.13	20	1.12
ILLINOIS.					
Chicago		139,914	3.12		1.08 to 1.12
Decatur	55,000	11,300	2.43	18	1.10
Granite City	8,750	12,500	2.64	16	1.08
INDIANA.					
Muncie		641	2.69	16	1.08 to 1.12
IOWA.					
Cedar Rapids		5,921	2.95	16	
KENTUCKY.					
Louisville		9,133	3.17	20	1.08
LOUISIANA.					
New Orleans	47,370	13,257	3.25	12	1.10 to 1.14
MAINE.					
Augusta		1,157	3.42	16	1.10
Bangor		720	6.11		
MARYLAND.					
Baltimore	2,195	1,647	3.40		
MASSACHUSETTS.					
Boston		2,522	3.50	20	1.12
Cambridge	23,900	29,037	4.00	22	1.12
New Bedford		1,520	3.50		
Southbridge		7,300	3.48		
Springfield		10,844	3.30	20	1.10
MICHIGAN.					
Detroit	145,000	114,818	2.52	16 to 20	

Brick Pavements (cont.)

Boonton		5,790		2	g
Camden		611	2.10	1	g
Elizabeth		10,000	2.11	1½	g
Garfield		9,071	2.34	2	g
Jersey City		8,649	2.11	1½	g
Newark	10,000	33,389	2.20	1½	g
Ridgewood	20,000		2.25	2	g
Rutherford		20,000	2.15	1½	g
Trenton	4,540	7,022	2.24	1½	g
NEW YORK.					
Albany		72,774	2.01	1½	g
Auburn	2,634	5,246	2.45	1½	g
Ballston Spa		4,013	2.55	2	g
Binghamton	23,000	35,257	1.98	1½	g
Buffalo		40,467	3.29	1½	g
Canastota	5,089		2.15	1½	g
Carthage		7,500	2.49	1	g
Catskill	5,000				
Clyde	4,220			2	g
Corning	956	33,498	2.04	1½	
Cortland		9,850	2.28	1½	
Elmira	10,000	27,690	2.33	1½	g
Fairport		4,870	2.25	2	g
Fulton	7,200	4,222	2.48	1½	g
Gloversville		6,000	3.00	2	g
Hornell	800	3,700	2.03	1½	g
Ithaca		4,316		1	g
Jamestown	50,000	38,580	1.65	1½	g
Kingston		2,000	2.40	2	g
Little Falls		1,100	2.65		
Lockport		17,037	2.25	2	g
Middletown		5,000			
Newark	9,000	3,000	1.60	1½	g
New York City—					
Brklyn. Boro.	12,700			1	g
Richm'd Boro		4,365	1.63	1½	g
Niagara Falls		5,000	2.62	1½	g
Norwich		14,000	2.20	1½	g
Olean	Some	12,552	1.95	2	g
Oswego	23,140	27,737	2.43	1½	g
Plattsburg	3,000	5,420	3.05	1½	g
Port Jervis	6,900	5,790	2.45	1½	g
Poughkeepsie		25,924	2.50	2	g
Rochester		78,791	1.83	1½	g
Salamanca		800	2.25	1½	p
Schenectady		7,536	2.33	1	g
Solvay		15,351	2.67	1½	g
Syracuse	100,000	73,480	2.19	1½	g
Troy		4,218	2.73	2	g
Utica		870	2.36		
Watertown		10,000	2.53	1½	g
NORTH CAROLINA.					
Asheville		7,040	2.45	1½	p
Charlotte		1,920	2.45	4	g
Raleigh		980			
OHIO.					
Ada	12,000				p
Akron	125,417	188,711	1.47	2	g
Alliance		16,000	1.75	2	g
Ashland		2,236	1.95	2	p
Ashtabula		8,888	1.64	2	a
Barberton		4,051	1.65	2	p
Bellefontaine		9,873	1.45	1	g
Bryan		4,000	1.74	2	g
Bucyrus		650	1.39	2	g
Cambridge	15,000	3,750	2.61	1½	g
Canton		100,728	1.63	2	p
Chillicothe	11,500	5,450	1.41	1	g
Cincinnati		99,411	2.28	2	g
Cleveland	283,344	509,097	2.07	1½	g
Columbus		216,195	1.75	2	g
Conneaut	16,350d	1,610	1.50	1½	g
Coshocton	2,000	2,274	1.50	2	p
Dayton	80,400	60,130	1.72	1½	g
Delaware	7,000	19,000	1.60	2	g
E. Liverpool	30,000	14,110	1.35	2	s
Elyria		27,352	1.95	2	a-g
Galion	37,000	9,555	2.13	2	g
Geneva		5,308	1.65	1½	g
Greenville		550	1.70		
Ironton		28,100	1.33	2	p
Lakewood		60,249	1.68	1½	g
Lancaster	37,000	24,140	1.00	2	s
Lima		28,069	1.83	1½	g
Lorain	20,000	21,119	1.68	1½	g
Mansfield	27,650	9,700	2.39	1½	p
Marietta		19,094	1.15	2	s
Marion	20,000	16,471	1.85	2	g
Massillon		29,000	1.74	2	p
Middletown		8,189	1.81	2	g
Mingo Junction	4,700	0	1.30	2	s
Mt. Vernon	9,800	1,344	1.80	2	g
Newark	3,590	19,856	1.45	2	g
Norwalk		8,000	1.90	2	g
Norwood		1,420	1.49	1	g
Oberlin	2,700	9,400	1.65	1½	g
Ottawa		8,000	1.97	1½	g
Painesville	20,650		1.66	1½	g
Portsmouth	15,000	80,347	2.00	2	p-g
Sandusky		13,000	1.81	2	g
Sidney		54,980	2.33	1	g
Steubenville		22,570	1.63		
Tiffin		7,400	1.85	2	g
Tippecanoe Cy.		22,200	1.78	2	g
Toledo	Some	68,514	2.03	1½	a-g
Urbana		18,000	1.89	1½	g
Van Wert		6,900			g

Concrete Pavements (cont.)

Springfield		36,871	1.60	1	6
Worcester		116	1.50	1	6
MICHIGAN.					
Allegan		14,500			
Cadillac	38,000	29,334			
Detroit		165,700	2.28	2	7
Dowagiac		6,000			
Flint		19,381	1.65	1	6-8
Frankenmuth		7,000	0.85		
Grand Rapids	5,000	1,740	1.10	2	6½
Highland Pk. *a*	Some	12,480	1.41	2	6-8
Howell		1,833	0.85	2	8
Lansing		3,100			
Laurium		6,600			
Manistee	1,000	653	1.40	2	7
Menominee	3,750		1.27	2	7
Monroe	3,500	1,200	1.60	2	6
Munising		2,000	1.50	1	6
Paw Paw		1,600	1.30		7
Petoskey		2,785	1.17	2	8
Plymouth		3,500	1.00		
Port Huron *a*		9,132	1.26	2	6½
Royal Oak	68,000	52,356			
Spring Lake		4,300	0.70		6
Three Rivers		1,220	0.92		
Union City		4,800		1	
Vicksburg		4,500	1.20		6
Wyandotte		3,960			
Ypsilanti	30,000	8,100	1.18	2	7
MINNESOTA.					
Anoka	5,000	900	1.45	1	6
Austin		300	1.60	1	7
Duluth	35,000	55,399	1.80	1	8
Faribault		980	1.45	2	7½
Mankato	4,000	18,558	1.02	1	6
Minneapolis	50,000	64,886	1.29	1	7
Moorehead		7,200	1.65		6
Mt. Iron		4,300	1.38		7
Nashwauk		3,900	1.65		7½
Pipestone		8,300	1.58		6
Red Wing		588			
Rochester	4,100		1.51	1	7
St. Cloud	20,000	10,304	1.22	1-2	7
St. Paul	10,000	6,677	1.35	2	6½
Stillwater		1,602	1.25	2	
Two Harbors		10,200	1.86		6-8
Virginia		525	2.40	2	15
MISSOURI.					
Bethany		3,400	1.40		6
Boonville		25,000	0.84	1	6
C. Girardeau	53,000	67,047	1.09	1	6
Chillicothe		19,900	1.40	1	5
Columbia	2,960	5,201	1.01	1	6
Excelsior Spgs.		1,400	1.34	2	6
Grant City		8,100	1.10		7
Hannibal		23,000	1.03	1	6
Joplin		400			
Kansas City	350,000	326,948	0.97	1	6-8
Kirksville		4,120	1.56	2	7
Liberty	10,000	2,100	1.57	2	5½-8
Poplar Bluffs		2,850			
St. Joseph		61,275	1.25		5-6
Sedalia	8,000		1.23	1	6
Sikeston		3,500	1.48	1	6½
Springfield		19,925	1.18	2	5½
MONTANA.					
Billings		5,970	1.52	1	6½
Bozeman		1,947	1.95	1	6
Great Falls		4,545	1.31	1	6
Missoula		643	1.80	2	6
NEBRASKA.					
Lincoln	12,550	1,951	1.38	2	6
Nebraska Cy.	50,000	9,953	1.18	2	6
Norfolk	40,000		1.25	1	6
Omaha *e*	53,061	11,381	1.44	1	6
Omaha *c*		6,055	1.59	1	6
So. Omaha	17,000	8,312	1.30	1	7
NEW HAMPSHIRE.					
Nashua		6,830	1.65		6-8
NEW JERSEY.					
Bloomfield	10,000				6
Elizabeth		2,200	1.15		5-7
Red Bank		6,800	1.47		6-8
Roselle Pk.	17,000	14,759	1.28		5-7
NEW YORK.					
Albany		2,275	1.72	1	5-7
Bay Shore		18,750			
Canajoharie		4,000			
E. Islip		7,800			
Ellenville		2,060			
Gloversville	9,500	5,500	1.45	2	6
Gowanda		9,400			
Interlaken		12,000	1.10	1	6
Johnstown		7,04[illegible]	0.90	1	7
Sag Harbor		14,640	1.54		5-7
Saratoga Spgs.		12,500			
Schenectady		1,150	1.45	1	7
Schoharie		8,700			
Seneca Falls		1,947		1	7
Tonawanda		23,000	1.44	1	6
Troy	9,200	9,348	2.10	1	
W. Albany		3,100			
W. Carthage		8,900	2.14		5-7
NORTH CAROLINA.					
Bessemer Cy.		21,000		2	
Charlotte		373		2	6
OHIO.					
Andover		14,900	0.80		6
Canton		11,000	1.40		

Bituminous Macadam (cont.)

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick. Inches.	Foundation.	
Westfield	.....	5,042	1.00	½	5½	
W. Springfield	.....	2,140	...	...		*w*
Winchester	.....	12,643	...	...		....
Woburn	.....	25,000	0.98	...		....
Worcester	.....	30,776	0.87	6		....
MICHIGAN.						
Grosse Pointe	.....	11,168	...	...		*w*
Ludington	.....	11,000	...	...		....
Norway	.....	13,269	0.69	4		6*a*
So. Haven	.....	9,000	.....	0.70	2	6
MINNESOTA.						
Minneapolis	.....	958	1.73	...		*c*
MISSOURI.						
Columbia	.....	925	0.80	8		6
Jefferson City	.....	94,008	0.90	8		....
Kansas City	50,000	55,037	1.30	3		7
Sedalia	.....	4,000	.....	1.00	8	6
NEW HAMPSHIRE.						
Berlin	.....	1,560	0.78	...		....
Laconia	....	5,000	3,153	0.85	6	*n*
NEW JERSEY.						
Bloomfield	..	5,000	.....	...	8	....
Garfield	....	7,220	57,890	0.93	7	*n*
Kearney	....	.....	5,710	...	...	*w*
Montclair	...	6,000	5,900	0.87	3	*t*
Passaic	.....	12,000	15,612	0.92	7	*m*
NEW YORK.						
Carthage	...	.....	3,15*v*	1.10	12	....
Fulton	.....	.....	20,138	1.35	7	*g*
Geneva	.....	.....	32,358	0.50	...	....
Gloversville	..	7,650	14,200	1.38	6	*m*
Gouverneur	.	.....	4,000	...	...	....
Hempstead	.	.....	8,584	...	...	*w*
Herkimer	...	.....	6,000	0.20	...	....
Hornell	.....	.....	1,000	...	...	....
Jamestown	..	.....	12,338	1.35	...	....
Johnstown	..	.....	3,500	1.52	8	....
Mamaroneck	.	.....	2,368	...	...	....
Middletown	.	.....	15,000	...	...	....
New York—						
Queens	....	.....	110,585	0.85	...	....
Richmond	..	.....	8,723	...	...	....
Oneonta	....	13,700	4,639	1.12	7	4
Oswego	.....	.....	16,121	1.73	6	*s*
Plattsburg	..	.....	16,460	0.86	8	....
Poughkeepsie	.....		1,526	1.30	7	....
Syracuse	....	.....	13,650	1.50	9	6
Troy	.....	.....	7,800	1.09	...	....
Utica	.....	.....	11,666	1.01	...	....
NORTH CAROLINA.						
Durham	.....	25,000	11,500	0.74	6	...
Rockingham	.	.....	10,666	...	...	....
OHIO.						
Bellefontaine		1,300	.....	0.58	8	....
Cincinnati	..	15,325	39,657	1.51	9	....
Columbus	...	.....	6,366	1.20	...	....
Galion	.....	37,000	.....	...	2	6
Massillon	...	.....	2,500	0.75	...	....
Middletown	..	.....	9,473	1.36	2½	6*c*
Springfield	..	.....	5,000	0.90	...	....
Toledo	.....	.....	6,155	1.19	4	4
OREGON.						
Hood River	..	.....	9,000	1.00	6	....
Portland	.....	.....	10,000	...	...	....
PENNSYLVANIA.						
Allentown	...	.....	1,731	0.70	...	....
Ben Avon	..	.....	2,000	1.08	4	*t*
Clearfield	...	.....	1,200	0.85	3	*b*
Columbia	...	.....	500	0.54	...	....
Hanover	....	.....	16,696	2.05	...	....
Lansdowne	..	8,000	5,200	1.20	6	*t*
Marcus Hook	.....		13,815	...	...	*w*
Steelton	....	.....	20,032	...	...	....
Waynesboro	.....		634	1.77	...	....
RHODE ISLAND.						
Pawtucket	..	.....	625	...	2	4
Providence	..	40,000	39,436	1.51	2⅜	5
SOUTH CAROLINA.						
Columbia	...	.....	10,150	...	2	4*c*
Union	.....	.....	7,500	1.00	...	....
TENNESSEE.						
Nashville	...	75,000	35,000	1.40	3	6
TEXAS.						
Abilene	.....	.....	42,534	0.74	...	....
Dallas	.....	.....	5,044	1.00	9	*s*
Hillsboro	....	.....	1,400	1.35	...	....
Longview	...	.....	28,595	1.13	9	....
Marshall	....	.....	3,000	1.32	...	....
Mineral Wells	.....		10,000	1.04	2	4*c*
VERMONT.						
Barre	.....	.....	3,600	0.62	...	....
Rutland	.....	.....	9,350	0.75	4	*s*
VIRGINIA.						
Danville	....	.....	1,000	0.76	2	5
Newport News	.....		10,000	0.60	...	....
WASHINGTON.						
Sumner	.....	.....	6,720	...	...	*w*
WEST VIRGINIA.						
Bluefield	....	.....	30,800	1.48	2½	*c*
Edgewood	...	.....	25,500	...	...	*w*
WISCONSIN.						
Baraboo	.....	.....	1,500	...	...	....
Chippewa Falls	....		8,000	1.51	9½	....
Columbus	...	9,650	.....	1.00	5	*m*
Eau Claire	..	1,900	1,000	1.10	7	*a*
Edgerton	...	.....	7,600	1.16	9	....
Janesville	...	.....	4,245	1.05	9	....
LaCrosse	....	18,000	8,455	1.65	2½	5*c*
Madison	....	5,000	34,908	1.28	2¼	*t*
Milwaukee	..	10,000	14,709	1.27	7	5

Bituminous Concrete

See also "Concrete with Bituminous Top."

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick. Inches.	Foundation.	
ALABAMA.						
Birmingham	.....	17,228	1.52	...	....	
Gadsden	....	.....	11,500	1.48	...	....
Mobile	.....	.....	20,603	1.36	...	....
New Decatur	.....		64,600	1.53	2	4*c*
ARIZONA.						
Phoenix	.....	.....	17,557	1.20	...	....
CALIFORNIA.						
Hollister	....	.....	32,805	0.88	6	....
Marysville	..	.....	5,481	1.62	...	....
Oakland	....	.....	300,386	0.87	8	*s*
Pasadena	...	.....	23,000	1.48	4–7	....
Richmond	...	.....	25,100	1.52	7	....
S. Pasadena		40,000	73,791	1.34	5	*n–w*
Stockton *e*	...	.....	57,318	1.25	...	....
Vallejo	.....	.....	19,653	1.25	...	....
Venice	.....	33,494	47,361	1.92	6	*w*
CONNECTICUT.						
Bridgeport	..	200,000	1,360	1.35	2	*m-w*
Putnam	.....	.....	10,000	...	...	....
Wallingford	.	.....	12,413	1.20	7½	....
DELAWARE.						
Wilmington	.	.....	19,000	...	2	*c*
Wilmington	.	.....	6,400	...	...	*b*
DISTRICT OF COLUMBIA.						
Washington	.	.....	42,000	1.64	...	....
FLORIDA.						
Jacksonville	.	.....	43,717	2.38	...	....
GEORGIA.						
Atlanta	.....	.....	85,311	...	...	....
ILLINOIS.						
Chicago	....	.....	268,142	1.48	...	....
Cicero	.....	.....	101,162	1.40	...	....
Elgin	.....	.....	35,030	1.55	...	....
Hinsdale	....	.....	8,000	1.42	8–10	...
Kewanee	....	.....	28,000	1.47	2	5*c*
Lake Forest	..	.....	12,000	1.00	5	*m*
Marion	.....	.....	12,000	1.30	3½	8*c*
Murphysboro	.....		41,000	1.25	2½	7*c*
Oak Park	...	99,118	131,103	1.35	2	6*c*
Waukegan	..	.....	10,832	1.60	...	....
Wilmette	...	.....	8,575	1.55	2	6*c*
INDIANA.						
Elkhart	.....	.....	15,880	1.65	...	....
Ft. Wayne	...	.....	55,307	...	...	....
Frankfort	...	1,955	5,531	1.44	2	5*c*
Gary	.....	4,210	16,232	1.33	3	6
Laporte	.....	.....	13,561	2.69	...	....
South Bend	..	.....	15,986	1.78	...	....
IOWA.						
Algona	.....	.....	36,427	1.53	2	4*c*
Belle Plaine	.	.....	28,187	1.61	2	4*c*
Boone	.....	49,000	70,000	1.55	2	5*c*
Cedar Rapids	.....		14,760	1.95	...	....
Cherokee	....	.....	40,547	1.66	2	4*c*
Des Moines	..	.....	5,966	1.76	2	5*c*
Dubuque	....	.....	2,200	1.67	...	*c*
Dubuque	....	.....	44,262	1.81	2	5*c*
Ft. Dodge	...	.....	40,857	...	...	....
Waterloo	...	.....	6,440	1.69	...	....
KANSAS.						
Abilene	.....	12,000	45,402	1.44	2	4½
Emporia	....	.....	35,000	1.40	2	4*c*
Junction City	.....		66,000	1.31	2	5*c*
Manhattan	..	.....	73,085	1.34	...	....
McPherson	..	.....	47,886	1.27	2	4*c*
Newton	.....	100,000	.....	1.18	2	....
Parsons	.....	.....	10,000	1.24	2	4*c*
Salina	.....	.....	14,000	1.50	...	....
Topeka	.....	21,700	29,866	1.35	2	4
KENTUCKY.						
Dayton	.....	.....	4,500	1.19	9	....
Louisville	...	.....	10,138	0.87	...	*o*
LOUISIANA.						
Lake Charles	.....		35,000	1.70	2	5*c*
New Orleans	.....		3,490	1.48	2	6
Shreveport	..	.....	33,234	1.63	...	....
MAINE.						
Portland	.....	.....	7,033	1.08	...	....
Rumford	....	.....	1,200	1.18	...	....
Saso	.....	.....	1,600	1.25	...	....
MARYLAND.						
Frederick	...	.....	5,183	1.60	...	....
MASSACHUSETTS.						
Pittsfield	...	.....	30,567	1.94	3	5*c*
Springfield	..	.....	25,861	1.40	2	*c*
Springfield	..	.....	15,335	0.89	2	*o*
Southbridge	.	.....	1,700	1.22	8	....
Westfield	....	6,200	1,720	1.75	2	5
MICHIGAN.						
Ann Arbor	...	19,000	.....	...	2	6
Battle Creek		30,000	13,212	1.54	2	5
Benton Harbor	....		15,000	1.35	...	....
Detroit	.....	.....	190,610	2.44	2	6*c*

Oiled Streets (cont.)

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Thick. Inches.	Foundation.	
Richmond	.....	72,775	0.91	2		*b*
Santa Ana	Some	70,400	....	1		...
S. Pasad'na	.....	3,000	0.27	2		*s*
CONNECTICUT.						
Ansonia	..	100,000	.....	0.015	1	*a*
Bridgeport	...	1,296,000	1,308,652	0.008	2	*d*
Hartford	.	.....	1,386,108	0.027	3	*a*
N. Britain		4*c*	3*c*	...	...	...
Putnam	..	30,000	30,000	0.03	2	*a*
FLORIDA.						
Dade City	.....		4,000	0.55	...	*e*
ILLINOIS.						
Oak Park	.	475,180	464,100	0.01	1	*f*
INDIANA.						
Huntington		1,451	24,000*l*	0.02*l*	1	*s–n*
Lafayette		185,000	182,300	0.04	1	*gs*
Laporte	..	10,000	.....	....	2	*a*
Logansp't		15,000	10,000	0.02	1	*g*
Mt. Vernon	.....	.....	....	1		*s*
IOWA.						
Waterloo	.	40,000	57,160	0.025	1	*n*
KANSAS.						
Hutchins'n	.....		40,000	0.04	2	*a*
Newton	..	.....	20,000	0.10	2	...
MAINE.						
Augusta	..	.....	234,310	0.026	2	...
Portland	.	.....	32,029	0.025	1	*a*
MASSACHUSETTS.						
Boston	...	.....	31,976,396	0.016	4½	*s*
Greenfield		210,000	210,000	0.025	2–3	*a*
Lawrence	.....		308,900	0.014	2.13	*a*
Lawrence	.....		16,020	....	...	*h*
Lowell	...	1,500,000	1,024,967	0.012	3–4	*ags*
Norwood	.	300,000	.....	....	2–3	...
Peabody	.	440,000	360,000	0.022	2–3	*ar*
Revere	...	38,000	20,000	0.02	2	*s*
Springf'ld	.....	1,500,000	....	1–4		*a*
MICHIGAN.						
Ludington	.....		30,000	....	1	...
S. Haven	..	20,000k	10,000k	....	...	...
MINNESOTA.						
Mankato	.	85,000	70,000	0.02	1	*gs*
Min'apolis		1,000,000	994,610	0.014	2	*a*
Northfi'ld		80,000	.....	....	...	*r*
MISSISSIPPI.						
Clarksd'le		12,000	18,000	0.075	2	*n*
Jackson	..	50,000k	.....	....	...	...
Meridian	.	.....	10,000	0.15	1	*o*
MISSOURI.						
Milan	....	12,500	12,500	....	1	...
Sedalia	..	18,000	9,000	0.20	2	*n*
Windsor	.	30,000	24,000	0.03	2	*n*
NEW HAMPSHIRE.						
Laconia	..	.....	150,000	0.02	1–2	*gt*
NEW JERSEY.						
E. Orange	.....		800,000	0.025	3	*r*
Montclair	.	700,000	710,000	0.011	1–4	*s*
Ocean City	.....		12,000	0.120	...	*u*
Passaic	..	125,000	149,000	0.055	1–2	*s*
Ridgewo'd		72,000	72,000	0.055	1	*u*
Rutherf'd		140,000	27,000	0.200	2	*a*
Summit	..	70,000	.....	0.065	1	*ao*
NEW YORK.						
Auburn	..	200,000	200,000	0.015	1	*a*
Clyde	....	14,800	7,400	0.003	3	*g*
Gloversv'le		25,000	25,000	0.018	1	*sg*
Hornell	..	.....	40,000	0.058	1	*sn*
N. Y. City—						
Br'klyn Boro	.	.....	2,114,226	0.017	1	*sn*
Oneonta	..	45,000	67,000	0.018	1	*a*
Pt .Jervis		107,000	107,000	0.018	1	*a*
Syracuse	.	.....	39,674	0.020	1	*a*
OHIO.						
Gr'nville	.	18,000	27,000	0.030	1	...
Mansfield	.....		8,450	....	1	*a*
Norwood	.	180,000	.....	0.020	1	*s*
OKLAHOMA.						
Enid	.....	13,195	.....	....	2	*r*
Frederick		12,000	.....	....	...	...
Okmulgee	.....		15,000	....	3	...
OREGON.						
Hood Riv'r		20,000	10,000	1.000	2	*v*
PENNSYLVANIA.						
Ben Avon	.	8,000	9,000	0.120	1	*o*
Carlisle	..	200,000	160,000	0.008	2	*r*
Coatesv'le		43,325	43,325	0.012	1	...
Lansdowne		18,000	16,000	0.072	1	*o*
Parkersb'g		3,400	3,400	....	2	...
Philadelphia	.....		1,064,778	0.014	1	*a*
TEXAS.						
Longview	.....		18,500	....	1	*r*
VERMONT.						
Rutland	..	60,000	40,000	0.020	2	*a*
WASHINGTON.						
Sunnyside	.....		20,000	0.035	3	*gn*
WISCONSIN.						
Antigo	...	125,000	100,000	0.015	2	*a*
Columbus		40,000	37,050	0.019	2	*sn*
Eau Claire		75,000	46,000	0.029	1	*s*
Milwa'kee		2,418,800	2,428,800	0.160	1	*o*
Oshkosh	..	100,000	.....	....	...	*a*

Wood Block (cont.)

Detroit *w*		148,151			
Flint		9,028	3.04	16	1.10 to 1.14
Highland Pk.	8,972		1.84	16	1.10
Monroe	750	544	4.02	16	1.12
Saginaw	12,143		2.58	16	1.08 to 1.12
MINNESOTA.					
Austin	11,000	5,064	2.19	16	1.10
Eveleth		8,053	2.50	16	
Hibbing		7,584	2.54		
Mankato	20,000			16	
Minn'p'lis *a*	250,000	182,930	2.36	16	1.10
Minn'p'lis *b*		12,369	2.08	16	1.10
New Ulm		15,204	2.31		
Owatonna		10,397	2.11	16	1.10
Red Wing		6,766	2.07		
Rochester		16,540	2.17	16	1.10
St Paul	110,000	252,673	2.43	16	1.10 to 1.14
Virginia		16,073	2.48	16	1.10
MISSISSIPPI.					
Laurel	9,200	7,447	2.75	20	1.10
MISSOURI.					
Excelsior Sp.	605		2.60	16	1.09
Kansas C. *c*	50,000	82,547	2.71	16	1.08 to 1.10
St. Louis		5,000	2.60	16 to 20	
MONTANA.					
Billings		5,285	3.17	16	1.08 to 1.12
Butte		500	4.00		
Great Falls		13,470	2.80	16	1.08 to 1.14
NEW JERSEY.					
Atlantic Cy.	30,850		3.01		
Jersey City		5,622	2.99	20	1.03 to 1.10
Newark	40,000	73,151	3.34	18	1.07 to 1.12
NEW YORK.					
Albany		9,623	3.50	20	1.08
Binghamton *b*	1,620	1,587	2.38	16	1.03 to 1.14
Johnstown		1,118	3.85		
New York City—					
Brkyn. Boro	4,000			20	1.12
Manh. Boro.		109,569			
Richm. Boro		26,775	1.90	18	1.03 to 1.14
Rochester		3,390	2.90		
OHIO.					
Akron		18,840	2.46		
Cincinnati	3,700	44,015	2.83	18	1.10
Cleveland	6,295		2.98	16	1.08 to 1.12
Dayton	3,670	15,440	2.42	20	1.10
Galion	37,000			12	1.10
Norwood	18,000	22,000	2.20	18	1.04
Toledo		23,729	3.15	16	1.03 to 1.09
OREGON.					
Eugene	1,262				
Portland		12,108	2.60	14	1.05 to 1.10
PENNSYLVANIA.					
Philadelphia	40,000	31,224	3.29	18	1.03 to 1.14
Pittsburgh	4,000	12,000	3.05	16	1.03 to 1.08
Reading		13,291	3.43	16	
RHODE ISLAND.					
Providence	39,820	7,479	3.25	18	1.10
SOUTH CAROLINA.					
Charleston		26,654	2.36	16	1.08 to 1.14
Orangeburg	2,100		2.46	16	
SOUTH DAKOTA.					
Sioux Falls		13,900	2.67	16	1.10
TENNESSEE.					
Memphis		2,478	2.38	16	1.08 to 1.14
Nashville	50,000	50,000	2.65	12	1.10
TEXAS.					
Austin		7,418			
Dallas *a*		18,761	2.98	18	1.06 to 1.10

Brick Pavements (cont.)

Washington C. H.	45,000	8,300	1.88	1½	*a*
Zanesville	35,000	94,000	1.60	1½	*g*
OKLAHOMA.					
Bartlesville		5,675	2.70	1½	*g*
Okmulgee		808	2.20	2	
Tulsa	4,000	12,000	1.85	1	*a*
OREGON.					
Portland		34,184	2.34	1	*g*
PENNSYLVANIA.					
Bloomsburg	12,300	6,555	1.45	1½	*g*
Bradford	800	4,150	2.07	1½	*g*
Carlisle	14,000	2,493	1.36	1½	*g*
Chambersburg	7,600		2.20		*g*
Charleroi	8,000	12,813	1.63	2	*s*
Clairton		2,358	1.53	2	*p*
Clearfield		3,900	1.85	2	*p*
Connellsville	38,000	5,670	1.36	2	*s*
Corry		6,125	2.15	1½	*g*
Donora		11,494	1.74		*s*
DuBois	7,115	8,645	2.16	2	*g*
Easton		6,418			
Edwardsville		9,000	2.28	2	*g*
Ellwood City		11,803	1.35	2	*g*
Erie		1,583	1.67	1½	*g*
Farrell		5,564	1.45	1	*p*
Franklin	16,250	16,000	1.90		*g*
Greensburg	10,000	12,360	1.33	2	*s*
Greenville		2,567	1.95	1	
Hanover Tp.		22,793	2.43	2	*g*
Hazelton		1,556	2.27	2	*g*
Homestead	1,100	8,658	1.99		*s*
Jeannette		2,760		2	*s*
Johnstown		34,713	2.23	2	*g*
Kingston		12,230	2.24	2	*g*
Lancaster		1,206			
Lansford	7,802	5,997	2.46	2	*g*
McKees Rocks		400	2.10	1	*g*
Meadville		69,327	1.98	2	*g*
Monessen		2,295	1.88	2	*s*
Mt. Union	12,000	6,500	1.92	1½	*g*
New Brighton		16,000		2	*s*
New Castle		1,614	1.85	1½	*g*
N. Braddock	17,000	14,727	2.00	2	*s*
N. East		5,217	2.02	2	*p*
Oil City	8,400	21,174	2.20	1½	*a-g*
Philadelphia	Much	123,304	2.75	1½	*g-p*
Pittsburgh		36,500	1.90	1½	*g*
Pottstown		3,960	1.08	2	*g*
Pottsville		13,113			
Rankin	5,000	4,500	1.45		*s*
Reading		21,268	2.45	2	*g*
St. Marys		13,600	2.34	1½	*g*
Scottdale		6,160	1.55	2	*s-g*
Scranton		938	2.20	2	*g*
Somerset		2,250	1.32	2	*s*
Uniontown		25,000	1.60	2	*s*
Warren		9,357	2.80	1½	*p*
Waynesboro		28,628	2.25	2	*g*
W. Hazelton		14,691	2.39	1	
W. Homestead	19,500	6,000			
Wilkes Barre	21,000	18,069	2.28	2	*g*
Wilkes Barre Tp.		9,400	2.34	2	*g*
Williamsport	27,486	15,502	2.04	2	*g*
RHODE ISLAND.					
Westerly		303	2.58	2	*g*
SOUTH CAROLINA.					
Columbia		3,932	2.50	2	*p*
Greenville	16,000		1.99		
Orangeburg	3,865		2.15	1½	*g*
Spartanburg		3,991	2.15	1½	*g*
TENNESSEE.					
Memphis		7,113	2.08	1½	*g*
Nashville		110,000	2.23	2	*g*
TEXAS.					
Denison		3,310	2.27	2	*a*
Galveston	13,800	21,483	2.30	1	*g*
Greenville		90,000	1.70		*a*
Hillsboro		2,200	2.22	2	*g*
Houston		64,249	2.45	1	*a*
Longview		3,350	2.28	2	*g*
Sulphur Spgs.	35,000		1.85	1½	*a*
Waxahachie		14,759	2.16	2	*g*
VIRGINIA.					
Pocahontas		3,200	2.10	2	*g*
WASHINGTON.					
Seattle	60,000	72,771	2.50	2	*g*
Tacoma		525		1	*g*
WEST VIRGINIA.					
Bluefield		1,800	2.40	1½	*g*

Concrete Pavements (cont.)

Dayton	4,500	6,317	1.53	1	6
Elyria		1,065	1.40	2	6½
Fostoria		2,899	1.39	1	6
Greenville	7,075			1	6-8
Newark		450	1.13	2	
Norwalk	50,000	2,700	1.30	1	6
Norwood		10,235	0.95	1	6
Plymouth		5,100			
St. Bernard		500			
Sandusky	700	8,700	1.30	2	8
Sidney		10,110	0.95	1	6
Toledo		17,897	1.39	1	6-7
Troy		2,680			
Washington C. H.		2,084	1.56	1	7
White House		6,300			
Zanesville	10,000		1.30	1	7
OKLAHOMA.					
Durant	17,600		1.20	1	6
McAlester	12,900	1,563	1.22	1	6
Okmulgee	20,000			1	6
Tulsa	8,000		1.15	1	5
OREGON.					
Corvallis		5,561	0.92	1	6
Portland	4,391	70,304	1.24	1	6
Salem		2,562	1.10	1	6
PENNSYLVANIA.					
Bangor		384	1.44	1	8
Beaver Falls	1,000	320	1.17	1	6
Bellwood		390	1.35		
Carlisle	3,500	200	0.90	1	6
Catasauqua		610	0.80	1	
DuBois	3,000	3,953	1.63	2	5-8
Freeland		3,000	1.43	2	6
Hughesville		125	1.30	2	
Huntington		1,950			
Indiana	700	3,000	1.25	2	6-8
Juniata	8,000	11,047	1.51	2	6-8
Lansdowne	1,350		1.35	2	6
Mifflinburg		330	1.24	1	5-7
Nanticoke	90,000	70,400			
Nazareth		1,400			
Nicholson		8,100	1.51		5-7
Philadelphia		28,150	0.98	1	6¼
Pittsburg		5,000	1.35	1	6-8
Warren		3,572	2.50	2	7
Williamsburg		13,400	1.41		6-8
RHODE ISLAND.					
Cranston		1,520	0.68		5-6½
SOUTH CAROLINA.					
Columbia		2,969	1.35	2	6
Greenville *d*	15,000		1.39		
SOUTH DAKOTA.					
Aberdeen	580			1	6
Madison *d*	2,750				
Sioux Falls	10,000	1,913	1.60	2	6½
Watertown		600	1.80	2	8
Yankton	26,500		1.45	1	6
TENNESSEE.					
Johnson Cy. *f*		2,313	1.75	1	17
Memphis		23,843	1.15	1	6
Nashville	2,000		1.00	2	5
TEXAS.					
Austin	1,658	5,519	1.53	2	6
Belton		16,380	2.24	2	
Galveston		45,293	1.35	2	6
Greenville		35,000			
Hillsboro		7,875	1.75	1	5
Houston		9,399	1.90	1	6
Taylor	100,000	82,134			
Vernon		800			
Waxahachie	10,000	7,830	1.08	1	5
Wichita Falls	30,000	7,000	1.10	2	5½
UTAH.					
Logan		45,000	1.27	1	6-7
Ogden	2,200	15,410	1.32	2	6-7
Salt Lake	1,050	765	1.35	1	7
VIRGINIA.					
Pocahontas		1,200	0.75	1	6
Suffolk		2,240			
WASHINGTON.					
Aberdeen	30,000	2,768	1.25	2	8
Bellingham	30,759	56,287	2.28	1–2	7
Centralia	6,000	1,500	1.15	1	
Kent		11,000	1.20	1	6
N. Yakima		6,353	1.20	1	6
Olympia		3,658	1.08	2	6
Seattle	6,000	6,480	1.25	2	
South Bend	5,000	16,080	1.24	1	6
Spokane	40,000	2,732	1.25	1	6
Tacoma		6,116	2.09	2	6
Walla Walla	15,000	975	1.34	2	6
WEST VIRGINIA.					
Charleston		6,420	1.35	1	7
Parkersburg	50,000	11,673	1.67	1	5½-7½
Pennsboro	13,000	2,025	1.36	1	
W. Union		10,000	1.55		5-8
WISCONSIN.					
Appleton		9,128	1.40	2	5½-8½
Berlin	2,500	5,200	1.38	2	7½
Cedarburg		15,800			
Columbus	1,250		1.25	1	6-8
Eau Claire	10,200	10,000	1.27	1	5½-6½
Fond du Lac *a*	45,000	41,859	1.49	2	5½-8
Green Bay *d*	6,000	1,837	0.93	1	6
Kenosha		8,924	1.43	2	7
Kimberly		11,600	1.43	2	5½-7½
Lake Geneva	4,531		1.39	1	6-8
Madison	22,000	374	1.35	2	6-8

Bituminous Macadam (cont.)

City.	Proposed for 1915. Sq. Yds.	Laid in 1914.	Cost Sq. Yd.	Size block.	Filler.	
Racine	.....	7,614	1.69	10	....	
Wausau	15,000	10,500	0.63	...	....	
CANADA.						
St. Vital	.....	8,448	...	...		*w*
St. John	.....	15,586	1.05	6	....	
Ottawa	.....	25,000	1.80	...	....	
St. Lambert..	.....	7,100	1.00	...		*m*

a—Sand foundation.
b—On old brick pavement.
c—Concrete foundation.
e—Clay foundation.
g—On old gravel street.
m—On old macadam street.
n—On natural sub-grade.
r—Resurfacing.
s—Crushed stone foundation.
t—Telford foundation.
w—Warrenite.

Stone Block

City.	Proposed for 1915. Sq. Yds.	Laid in 1914.	Cost Sq. Yd.	Size block.	Filler.	
ALABAMA.						
Bimgham.	.....	4,979	$1.76	.....		*g*
CALIFORNIA.						
L .Angeles	.....	9,690	4.00	8-12 3½-4	..	
S. Fran. *o*	.....	22,049	3.28	6-6½		*a-g*
CONNECTICUT.						
Ansonia ..	1,350	20,000	1.74	10x5x4		*s*
Bridgpt. .	.....	12,418	3.30	7-12x 3½-4½ 4-4½		*c*
Derby ...	2,900	.....	1.70	10x5x4		*c*
Hartford	1,200	.....	3.56	10x5x4		*c*
Waterby. .	6,200	9,796	2.37	.....		*c*
DELAWARE.						
Wilmgt. .	.....	2,250	....	.....		*c*
GEORGIA.						
Savannah	.....	15,445	1.66	.....		*c*
ILLINOIS.						
Chicago ..	.....	40,340	3.78	.....		*p*
KENTUCKY.						
Louisville	29,500	6,165	3.76	.....		*c*
LOUISIANA.						
N. Orleans	.....	13,776	2.90	.....		*g*
MAINE.						
Augusta ..	.....	6,293	0.69	.....		*c*
Bangor ..	.....	1,407	1.45	.....		*s*
Biddeford	.....	14,000	....	.....	..	
Lewistown	.....	4,000	1.75	.....		*c*
Portland .	4,004	4,648	2.14	N. Y.		*c-s*
Portland *e*	.....	9,130	1.60	6		*c*
MARYLAND.						
Baltim. ..	111,065	72,661	3.30	.....	..	
MASSACHUSETTS.						
Boston ...	.....	13,439	3.25	6-8x 4x4-5½		*c-p*
Cambrdg.	.....	8,584	3.75	.....		*c*
Everett ..	.....	5,848	3.86	.....	..	
Fall River	.....	8,405	3.60	.....		*c*
Haverhill	1,070	1,177	3.00	12x8x4½		*c*
Holyoke .	.....	3,400	1.70	.....		*c*
Lawrence	8,900	82,598	2.74	10-13x 7-8x 3½-4½		*c*
Lowell ..	30,000	23,798	3.00	8x4x4		*c*
Malden ..	.....	13,388	2.96	.....		*c*
N. Bedford	.....	15,830	3.55	.....		*c*
Revere ...	3,000	.....	2.75	3½		*c*
Somerville	.....	3,000	2.85	.....		*c*
Springfield	Some	4,979	3.30	4		*c*
Woburn ..	.....	364	2.77	.....	..	
Worcester	.....	20,601	3.35	.....		*c*
MICHIGAN.						
Detroit ..	.....	12,495	3.13	.....		*c*
MINNESOTA.						
Duluth *f*..	3,000	6,258	2.75	.....		*c*
Minnapls.	5,000	7,931	2.28	6		*s*
Red Wing.	.....	1,941	2.69	.....		*c*
St. Paul *f*	14,000	1,136	3.33	.....		*c*
MISSOURI.						
Kan. City.	11,000	.....	3.40	5-6		*c*
NEBRASKA.						
S. Omaha.	.....	651	2.65	.....		*s*
NEW HAMPSHIRE.						
Laconia ..	1,000	400	2.95	.....		*c*
NEW JERSEY.						
Bloomfield	.....	30,000	3.28	.....		*c*
Camden ..	.....	58,872	2.82	.....		*c*
Elizabeth	.....	81,828	3.35	.....		*c*
Garfield ..	.....	9,094	3.40	8-12 3½-4½x4		*c*
Irvington	.....	22,000	....	.....	..	
Jersey Cy.	.....	26,195	3.20	.....		*g-p*
Newark ..	50,000	57,923	3.18	7-12x 5½x4		*g*
Newark *d*	25,000	25,714	2.57	12x6x5½		*g*
Passaic ..	8,800	1,803	3.60	.....		*c*

Bituminous Concrete (cont.)

City.	Proposed for 1915. Sq. Yds.	Laid in 1914.	Cost Sq. Yd.	Size block.	Filler.	
Grand Rapids	33,800	22,226	1.10	2		*c*
Kalamazoo ..	20,581	8,949	1.49	2		6
Kalamazoo ..	.....	19,230	0.90	...		*o*
Ludington ...	.....	24,000	0.92	2		*m*
Manistee	.....	5,151	1.30	2		5
MINNESOTA.						
Minneapolis .	.....	26,918	0.85	2		*o*
St. Paul	48,000	9,466	1.62	2		5*c*
MISSISSIPPI.						
Clarksdale ..	.....	2,500	1.82	1½		5
MISSOURI.						
Kansas City.	70,000	78,564	1.68	2		6
Marshall	.....	2,600	1.36	2½		4*c*
Nevada	.....	30,000	1.28	3		4*c*
NEBRASKA.						
Lincoln	.....	95,646	1.62	2		5*c*
Omaha	.....	13,291	1.63	2		5*c*
NEW HAMPSHIRE.						
Laconia	1,500	1,145	1.65	2		5*c*
NEW JERSEY.						
Camden	.....	58,872	2.85	...		....
Elizabeth	.....	80,000	1.10	2		*m*
Morristown .	.....	9,792	1.40	...		....
Trenton	25,000	50,183	1.47	2		5*c*
W. N. York..	.....	34,000	1.80	2½		5*c*
NEW YORK.						
Albany	.....	3,436	2.18	...		....
Fulton	.....	19,810	1.25	7		....
New York City—						
Bronx Boro.	65,500	122,969	1.45	...		....
Queens Boro	.....	110,585	0.85	4–5		*o*
Richmond Boro		62,876	0.90	...		*o*
Oswego	.....	16,193	1.50	5		....
Poughkeepsie	.....	1,526	1.30	7		....
Schenectady .	107,730	63,200	1.50	2		....
Syracuse	2,000	13,650	1.50	3		6
Utica	.....	4,324	1.92	...		....
NORTH CAROLINA.						
Greensboro ..	60,000	33,247	1.10	2		*m*
Raleigh	.....	84,319	1.70	...		....
OHIO.						
Ashtabula ...	.....	11,050	1.60	2		5*c*
Cincinnati ...	.....	4,206	2.27	...		....
Lakewood ...	.....	6,782	1.93	2½		6*c*
Lima	.....	3,680	1.50	...		....
Lorain	20,000	35,400	1.45	2		6*c*
Middletown .	.....	9,473	1.36	2½		6*c*
Springfield ..	.....	68,000	1.69	...		....
Toledo	.....	6,155	1.19	4		4
Wapakoneta	12,700	.....	1.70	2		6
OKLAHOMA.						
Tulsa	.....	20,000	1.49	...		....
OREGON.						
Corvallis	.....	16,050	1.43	1½		4*c*
Eugene	24,590	6,231	1.68	2		5
Portland	.....	7,291	1.25	6½		*s*
Portland	.....	138,085	1.38	5		....
Portland	.....	92,536	1.05	4		*o*
Salem	.....	12,487	1.26	...		....
Yoncallo	5,817	2,627	1.32	2		4
PENNSYLVANIA.						
Allentown ...	.....	12,852	0.95	...		....
Ben Avon ...	4,000	12,000	1.54	2		5*c*
Catasauqua .	2,800	1,560	1.40	2½		5*c*
Clearfield	.....	1,200	0.85	3		*b*
Dorrancetown	.....	26,710	1.58	2		5*c*
Easton	.....	11,798	1.99	...		....
Lancaster ...	.....	8,470	1.40	...		....
Philadelphia .	.....	73,260	1.21	2		*c*
Phoenixville ..	.....	4,600	0.85	...		*m*
Reading	.....	69,610	1.85	...		....
Williamsport	.....	7,834	1.20	...		....
RHODE ISLAND.						
Pawtucket ..	.....	6,472	...	2		4
SOUTH CAROLINA.						
Columbia ...	.....	48,900	1.44	2		4*c*
Greenville ..	40,000	.....	1.30	...		....
Spartanburg .	.....	86,362	1.45	...		....
SOUTH DAKOTA.						
Sioux Falls..	.....	113,059	1.70	...		....
Watertown ..	.....	23,000	1.71	2		5
TENNESSEE.						
Johnson City.	.....	6,069	1.75	...		....
Nashville ...	75,000	35,000	1.40	3		6
TEXAS.						
Denison	10,970	26,731	1.35	2		5*m*
Greenville ...	.....	30,000	1.59	2		4*c*

Oil Streets (cont.)

City.	Proposed for 1915. Sq. Yds.	Laid in 1914.	Cost Sq. Yd.	Size block.	Filler.	
CANADA.						
London, Ont. ...	545,600	545,600	0.022	1		*a*

a—Asphaltic oil.
b—Penetration method.
c—Cars of oil.
d—Standard dust laying.
e—Three inches of sand and asphaltic oil on rolled sand foundation.
f—Light, non-asphaltic oil, heavy asphaltic oil, Tarvia A and B.
g—Gravel.
h—Cinders with coal tar binder.
k—Gallons of oil.
l—Linear feet.
m—Miles.
n—earth.
o—Refined tar.
p—Petrolithic.
r—Non-asphaltic.
s—Macadam.
t—Clay.
u—Trinidad liquid asphalt.
v—Placing of 2-inch top of oil bound macadam.

Gravel Streets

City.	Proposed for 1915.	Constructed in 1914.	Cost Sq. Yd.	Rolled and Thickness.	
ALABAMA.					
Birmingham	.....	35,315	....	...	
Gadsden	.....	2,200	....	...	
Mobile	.....	300,000	0.16	...	
ARKANSAS.					
DeQueen	50*m*	100*m*	0.55	8	
Los Angeles	.....	240,000	0.65	*o*	
COLORADO.					
Oakland	.....	548,742	....	...	
Boulder	.....	4.7*m*	....	...	
Leadville	.....	4,000	0.25	*n*11	
Longmont	.....	37,000	0.26	*y*	
CONNECTICUT.					
New Canaan	.....	2,750	1.10	...	
Southington	.....	15,000	....	...	
IDAHO.					
Caldwell	.....	46,933	0.12	*y*	
Nampa	.....	3,800	6,175	0.07	*y*4
INDIANA.					
Anderson	.....	5,000	....	...	
Crawfordsville	.....	1,091	0.38	*n*5	
Lafayette	.....	5,263	0.90	...	
Lebanon	.....	771	0.40	...	
Newcastle	.....	2,000	0.90	...	
Noblesville	.....	4,240	0.20	...	
Richmond	15,000	23,200	0.40	*c-g*5	
IOWA.					
Cedar Falls	.....	23,000	....	...	
KANSAS.					
Abilene	.....	3,500	0.35	*y*7	
Iola	38,000	22,600	1.10	*a*	
KENTUCKY.					
Paducah	.....	8,400	0.45	...	
LOUISIANA.					
Lake Charles	8,000	9,000	0.36	3½	
Shreveport	.....	46,200	0.80	...	
MAINE.					
Augusta	.....	1.23*m*	0.38	*y*	
Portland	.....	997	0.07	*r*	
MASSACHUSETTS.					
Framingham	.....	18,700	0.58	...	
Greenfield	.....	15,000	....	*y*	
Lowell	80,000	82,210	0.20	*y*6	
Revere	1,800	1,200	....	*y*2	
Springfield	.....	9,000	....	*y*	
Stoughton	.....	23,000	0.25	...	
Watertown	.....	6,907	0.47	...	
Webster	.....	2,384	0.75	...	
MICHIGAN.					
Boyne City	.....	12,000	....	...	
Flint	.....	30,855	0.73	*n*11	
Grand Rapids	59,164	60,800	0.70	*y*9	
Port Huron	15,000	.....	....	*y*	
MINNESOTA.					
Crookston	30,000	25,000	0.17	*n*6	
Hibbing	.....	15,000	....	...	
Owatonna	.....	23,000	....	...	
Red Wing.	.....	30,000	....	...	
MISSISSIPPI.					
Clarksdale	27,000	2,800	0.60	*y*9	
Columbus	.....	1,000	....	...	
Hattiesburg	5,000	5,000	....	*y*	
Jackson	.....	50,000	0.25	*n*6	
Laurel	21,500	.....	....	10	
McComb	.....	60,000	....	...	
MISSOURI.					
University City.	.....	23,855	0.80	*b*	
NEW HAMPSHIRE.					
Berlin	.....	7,000	0.14	...	

Wood Block (cont.)

Dallas *d*			3.24	..	....
Galveston		5,199	2.70	18	1.03 to 1.08
Houston		73,275	....	16 and 18	1.03 to 1.10
Waxahachie		7,151	2.63	20	....
VIRGINIA.					
Bristol		250	3.00	..	....
WASHINGTON.					
Aberdeen		3,960	....	4	....
Seattle		2,778	....	..	....
Spokane	2,500	9,809	2.40	12	....
WISCONSIN.					
Eau Claire		1,800	1.60	16	1.07 to 1.10
Lake Geneva		21,288	2.14	16	1.09
Milwaukee	30,000	38,031	2.62	16	....
Neenah		2,051	....	..	....
West Allis	15,000		....	12	....
CANADA.					
S. Vancouver		65,743	3.55	..	....
Vancouver		27,268	3.14	12	1.06
Berlin		10,372	3.10	..	....
Ottawa		22,000	3.85	..	....
Toronto		5,795	3.55	..	....
Welland		6,098	3.05	..	....

a—3½-inch blocks.
b—4-inch blocks on old foundation.
c—on 6-inch foundation. $3.03 on 8-inch foundation.
d—4-inch blocks.
w—white cedar.

Brick Pavements (cont.)

Charleston		2,500	1.93	1½	*g*
Elkins	4,300		2.30	1½	*g*
Huntington	54,526	172,606	1.70		*s*
Logan		18,168	2.33	1½	..
Moundsville	7,500	8,800	1.03	2	*s*
Parkersburg	100,000	48,327	1.95	2	*g*
WISCONSIN.					
Appleton	1,600	11,586	1.99	1	*g*
Beloit	25,000		1.86	1½	*a*
Eau Claire		3,800	2.34	1½	*g*
Fond du Lac		3,095	2.34	1½	*g*
Grand Rapids		7,612	2.11	2	*g*
LaCrosse	5,500	4,613	2.23	2	*a*
Lake Geneva		325	1.11		*g*
Madison	2,782	3,987	1.90	2	*g*
Milwaukee	40,200	91,281	2.09	1½	*g*
Oshkosh	1,485	3,195	2.90	1½	*g*
Racine		84,010	2.03	2	*a-g*
Reedsburg		9,000	1.30	2	*s*
Sheboygan	4,800	7,693	1.98	1½	*g*
West Allis	15,000			1	*g*
CANADA.					
Vancouver		13,958	3.83	1½	*g*
London	4,030	6,933	2.73	1½	*g*
Toronto		38,417	2.07	1½	*g*
Welland		6,148	2.55	1	*g*

a—asphalt.
b—3-inch brick, $1.75.
c—cost does not include cost of brick.
d—kind not decided.
g—grout
p—pitch
s—sand.

Concrete Pavements (cont.)

Marinette	11,000	10,146	1.30	2	7
Milwaukee	30,000	3,018	0.90	1	6
Oshkosh *a*	2,027	20,686	1.29	2-3	7
Platteville		3,400			
Richland Center *d*	18,570	600			
Sheboygan	50,000	52,139	1.39	2	7½
S. Milwaukee		8,500	1.20	..	7
Stevens Pt.	23,000	24,267			
Superior	105,000	43,103	1.33	2	7½
Watertown	15,000	6,726	1.43	2	6-8
Waupaca		900	0.68	1	5-7
W. Allis *d*	23,000			1	7-8
Whitefish Bay		4,200	1.38	..	6-8
WYOMING.					
Sheridan	3,500		1.70	1	7
CANADA.					
Lethbridge	6,000			2	
Vancouver		10,367	2.01	2	7
St. John		2,172	1.70	1	8
Brantford		4,000	1.21	2	7
Chatham	12,500	8,589	1.12	1	6
London	9,680	4,755	1.55	1	7
Oshawa	10,000	14,000	0.90	1	5-7
Toronto		29,751		1	6
Windsor		67,348	1.25	2	6½
Westmount		5,235	2.75	2	6

a Reinforced concrete.
b Cost does not include cement.
c Granite concrete for streets.
d Kind not decided, will be concrete or some other kind named.
e For alleys.
f In street car tracks.

Oiled Streets (cont. from p. 353, 2d col.)

WISCONSIN.				
Appleton		45,000	0.35	*y*11
Eau Claire		12,600		
Green Bay	3,905	1,856	0.23	*n*
Oshkosh	500			*y*
Waupaca	1,500	2,000	0.19	*n*
CANADA.				
London, Ont	9,060	11,036	0.75	*y*
Estavan, Sask	5,000		0.12	*y*

a—National pavement.
b—Telford 7 inches, macadam 4 inches, gravel 1 inch.
c—Clay foundation.
f—Gravel bitulithic.
g—Gravel foundation.
h—Slag and ashes.
m—Miles of length.
n—Not rolled.
o—Oiled.
r—Resurfacing.
y—Rolled.

Stone Block (cont. from 2d col.)

Milwaukee	40,000	65,137	2.35	5-6	*c*
Sheboygan		1,680	3.28		*c*
CANADA.					
Vancouver		2,086	3.75		*c*
St. John		6,020	4.05		*c*
Halifax		2,200	4.25		*c*
Kingston		5,255	5.33		*c*
Ottawa		15,000	4.25		..
Westmount		1,448	4.53		*c*
Regina *b*		2,203	5.40	12x6x6	*g*

a—asphalt filler.
b—basalt block.
c—cement grout filler.
d—napped, reclipped granite, relaid.
e—relaying old blocks.
f—sandstone.
g—gravel filler.
p—pitch filler.
s—sand filler.

Stone Block (cont. from p. 353, 1st col.)

Provid.	37,458	10,327	3.75	7-12x 3½-4½x 4¾-5¼	*c*
Westerly		702	3.62		*c*
Woonsocket		12,000	3.65		..
SOUTH CAROLINA.					
Charleston		700		12x4x7	*s*
TENNESSEE.					
Nashville	18,000	35,000	2.45	10x4x5	*c-p*
VIRGINIA.					
Danville		2,000	1.30	10x4x6	*s*
WASHINGTON.					
Seattle *f*	3,000	3,694			*c*
WISCONSIN.					
Appleton	2,302		3.15	10x6x6	*c*
Madison		436	3.00	10x4x4	*c*

(Cont. in 2d col.)

Sidewalks, Curbs and Gutters

Sidewalks

City	Kind	Proposed for 1915 Sq. yds.	Laid in 1914 Sq. yds.	Cost
ALABAMA.				
Birmingham	*c*		26,157	0.81
Birmingham	*b*		1,681	1.19
ARIZONA.				
Phoenix	*c*		15,125	1.17
ARKANSAS.				
De Queen	*c*	6,000	10,000	0.99
Ft. Smith	*c*		6,964	0.81
Helena	*c*		550	0.99
Pine Bluff	*c*		170,890	1.08
CALIFORNIA.				
Alhambra	*c*	14,700	14,636	0.84
Colusa	*c*		3,500	1.08
Covina	*c*		10,000	1.08
Fresno	*c*		30,000	1.08
Huntington B'ch.	*c*	3,000		1.00
Imperial *r*	*c*		24,544	2.12
Los Angeles	*c*	284,000	246,160	0.90
Maryville	*c*		1,630	0.90
Monrovia	*c*	2,000	5,000	0.85
Oakland	*c*		125,746	0.95
Orange	*c*	*a*	250	0.81
Oxnard	*c*		2,000	1.00
Pasadena	*c*	7,696	14,804	0.81
Richmond	*c*		20,161	1.23
Riverside	*c*		4,306	1.17
Santa Ana	*c*	*a*	17,000	0.68

Curbs

City	Material.	Proposed for 1915. Lin. Ft.	Constructed in 1914. Lin. Ft.	Cost per Lin. Ft.
ALABAMA.				
Birmingham	*c*		3,019	0.40
Birmingham	*g*		1,510	0.50
Gadsden	*c*		2,600	0.57
Mobile	*g*		13,500	0.50
ARIZONA.				
Phoenix	*c*		20,000	0.50
ARKANSAS.				
Helena	*c*		5,531	0.20
CALIFORNIA.				
Alhambra	*c*		26,160	0.23
Covina	*c*		12,775	0.28
Fresno	*c*		21,000	0.48
Hollister	*c*	7,168	10,130	0.30
Huntington Bch.	*c*	6,000		0.35
Imperial	*c*		63,900	0.42
Los Angeles	*c*	450,000	384,773	0.33
Marysville	*c*		900	0.45
Monrovia	*c*	2,000	5,000	0.85
Oakland	*c*		98,988	0.50
Oakland	*g*		2,112	1.54
Oakland	*b*		107,552	0.11
Orange	*c*	*a*	250	0.81
Oroville	*c*	3,010	1,320	0.35
Oxnard	*c*		4,000	0.35
Pasadena	*c*	39,860	47,467	0.25

Gutters

City.	Material.	Proposed for 1915.	Constructed in 1914.	Cost Lin. Ft.
ALABAMA.				
Birmingham	*c*		3,639	$1.26
ARIZONA.				
Phoenix	*c*		17,000	0.55
ARKANSAS.				
Helena	*c*		6,439	0.20
CALIFORNIA.				
Alhambra	*c*		29,956	0.34
Covina	*c*		2,084	0.23
Fresno	*c*		21,000	0.33
Hollister	*c*	10,256	10,130	0.22
Imperial	*xcy*		35,500	0.40
Los Angeles	*c*	500,000	542,073	0.18
Los Angeles	*e*			0.35
Marysville	*c*		900	0.25
Monrovia		30,000	20,867	0.21
Oakland	*c*		307,844	0.21
Oakland	*k*		6,618	0.17
Oakland	*b*		33,240	0.69
Oroville	*c*	3,150	5,832	0.30
Pasadena	*c*	157,902	4,881	0.28
Richmond	*c*		47,122	0.25
Santa Monica	*c*		29,652	0.30
Venice	*c*		3,300	0.45
CONNECTICUT.				
Ansonia	*e*		3,000	0.20

Stone Block (cont.)

Trenton ..	1,430	1,546	4.00	5	c
W. Hoboken		3,270	1.50	.....	..
W. N. York		5,218	2.40	9x5½x4½	c
NEW YORK.					
Albany		9,246	3.45	6-12x 3½-4½x 4¾-5¾	c
Auburn *f*..		713	3.53	7-12x 3-5x 4¾-5¼	c
Buffalo ...	Some	11,280	4.23	.....	..
Ilion		2,500	3.44	.....	c
Lit. Falls.		1,800	4.00	.....	a
New York—					
Bronx ..110,200		86,486	2.94	.....	..
Brklyn. .100,000		94,908	2.85	10x4x5	p-g
Manhat.		169,689	2.84	.....	p-g
Queens		90,775	*h*	.....	p
Richm.		30,195	3.21	.....	c
Rochester		7,480	2.61	.....	c
Schenecdy.	1,000	1,700	3.54	10x8x4	c
Syracuse *f*	1,000	3,500	3.50	7-12x 3-5x5	c
Troy		61,811	3.92	.....	c
Utica *f*...	315	496	3.50	.....	..
NORTH CAROLINA.					
Raleigh		31,692	....	.....	..
OHIO.					
Akron		1,455	3.20	.....	p
Ashtabula		2,778	3.50	.....	a
Cincinnati	17,700	70,505	3.43	.....	..
Cleveld. *f*.	51,744	82,557	3.96	8-13x 3½-5x 6-6½	c
Columbus		2,520	3.52	.....	c
Norwood .	14,000	14,000	2.85	9x4x5	c
Toledo		3,200	....	.....	a-g
OREGON.					
P'tland. *b*.	11,000	2,427	2.85	5-8x 3-4x 4½-5	s
PENNSYLVANIA.					
Allentown		2,052	....	.....	..
Dunmore		2,250	2.90	.....	a
Johnstown		2,500	3.50	.....	p
Philad. ..	Some	10,922	3.58	3½-4½x	c-p
Philad. *d*.		39,000	....	.....	..
Pittsbg. *l*..		55,000	3.10	.....	c
Reading		1,686	2.49	.....	c
Scranton		15,010	2.25	.....	s
W.-Barre		513	3.25	.....	..
RHODE ISLAND.					
Pawtucket		862	....	.....	s

(Cont. on p. 352, 3d col.)

Bituminous Concrete (cont.)

Houston		85,108	...	2	5c
McKinney ...	23,100	13,960	1.46	2	5
Mineral Wells		20,000	1.62	2	4c
Waxahachie		17,185	1.87	...	....
UTAH.					
Salt Lake Cy.	10,000	.....	0.95	2	*m*
WASHINGTON.					
Aberdeen		2,727	1.45	2	6c
N. Yakima...		9,643	1.30	...	....
Seattle		9,000	1.35	...	....
Spokane	64,900	32,298	1.35	2	4c
WEST VIRGINIA.					
Bluefield		30,800	1.48	2½	c
WISCONSIN.					
Beloit	50,000	.....	1.22	2	5c
Chippewa Falls		8,000	1.51	9½	....
La Crosse ...	18,000	8,455	1.65	2½	5c
Madison	22,000	41,990	1.35	2¼	*t*
Oshkosh	17,116	.....	1.60	2	6
Racine		7,614	1.69	10	....
CANADA.					
Edmonton		64,368	2.53	2	6c
Vancouver		98,401	2.29	2	6c
Vancouver		7,406	1.65	3	*o*
Belleville		19,330	2.38	3	5c
Ottawa		25,000	1.80	...	....

b—On old brick pavement.
c—Concrete.
m—Old macadam.
n—Natural soil.
o—On Old base.
s—Crushed stone.
t—Telford.
w—Warrenite.

Oiled Streets (cont. from 3d col.)

Texarkana	50,000		0.25	...
Waxahachie	27,895		....	...
UTAH.				
Richfield	8,000	4,000	0.35	*n*9
VERMONT.				
Rutland	10,000	24,300	0.25	*y*6
VIRGINIA.				
Suffolk	2,000		0.37	...
WASHINGTON.				
Aberdeen	5,000	9,315	0.32	*y*
Bellingham		20,562	0.40	*y*9
Grandview		25,000	0.22	*y*7
Olympia 120,000		27,000	0.13	*n*
Vancouver		11,760	0.09	...

(Cont. on p. 352, 1st col.)

Oiled Streets (cont.)

NEW JERSEY.				
Atlantic City....	11,010	.....	0.41	...
Long Branch		100,000	....	...
Ocean City		10,000	0.27	*y*8
NEW YORK.				
Clyde	7,400	7,400	0.38	*y*8
Freeport		10,000	....	...
Herkimer		3,000	....	...
Norwich		2,000	0.20	*y*11
Oneonta 105,916		37,973	0.67	*y*
Port Jervis		60,000	....	*y*
Utica		23,000	....	...
NORTH CAROLINA.				
Greensboro	20,000	10,000	0.35	...
Raleigh		36,783	....	...
Roanoke Rapids.	2,000	5,000	0.25	*y*
OHIO.				
Dayton	30,000	47,640	0.40	...
Hamilton		24,000	0.25	...
OREGON.				
Eugene		5,905	1.10	...
Portland		128,084	1.43	5*f*
PENNSYLVANIA.				
Columbia		3,000	0.15	*h*
Freeland	4,000	5,700	0.34	*y*
S. Bethlehem.....		12,439	....	...
Williamsport		10,000	....	...
RHODE ISLAND.				
Pawtucket		10,000	....	...
SOUTH CAROLINA.				
Columbia		20,000	0.18	*y*6
SOUTH DAKOTA.				
Aberdeen	10,000	.....	....	*n*
TENNESSEE.				
Clarksville		9,000	0.12	...
Jackson		18,287	0.40	...
Memphis		51,527	0.50	...
TEXAS.				
Abilene		43,953	0.33	...
Dallas		24,992	....	*y*
Houston		158,317	0.70	*y*
Laredo		156,400	0.75	...
Longview		3,180	0.55	*y*8
Taylor		5,280	0.96	...

(Cont. in 2d col.)

Sidewalks (cont.)

Santa Monica...	*c*	31,161	1.02	
S. Pasadena.....	*c*	1,122	0.78	
Vallejo	*c*	100,000	0.75	
Venice	*c* 712	12,348	1.01	
COLORADO.				
Boulder	*c*	1,900	0.90	
Grand Junction..	*c*	2,500	1.08	
Leadville	*c a*	1,840	1.98	
Longmont	*c* 1,000	3,000	0.99	
Monte Vista.....	*c* 500	.....	...	
Pueblo	*c*	35,000	0.81	
CONNECTICUT.				
Hartford	*cs* 35,200	35,200	1.80	
Meriden	*c*	7,522	1.98	
Meriden	*s*	497	1.80	
New Britain.....	*c* 12,000	10,735	1.17	
Putnam	*c a*	500	1.30	
Southington	*c*	2,700	1.45	
DELAWARE.				
Wilmington	*p*	.....	...	
DISTRICT OF COLUMBIA.				
Washington	*c*	90,000	1.06	
FLORIDA.				
Bradentown	*c o*	15,000	1.01	
Dade City.....	*c*	8,000	1.26	
Gainesville	*c*	2,500	1.15	
Jacksonville	*c*	7,688	1.35	
Port Tampa.....	*c a*	2,677	1.08	
GEORGIA.				
Americus	*c* 5,000	1,777	1.08	
Atlanta	*d*	66,098	0.81	
Dublin	*d* 9,240	500	1.02	
Macon	*g*	8,000	0.90	
Savannah	*c*	3,000	0.90	
IDAHO.				
Caldwell	*c* 2,000	1,650	1.08	
Nampa	*c p*	335	1.26	
Twin Falls.....	*c*	1,000	1.26	
ILLINOIS.				
Alton	*c* 550	8,802	1.51	
Bloomington ...	*c*	35,000	0.99	

Curbs (cont.)

Richmond	*c*	44,085	0.34	
Riverside	*c*	3,765	0.30	
Santa Ana	*c a*	35,000	0.20	
Santa Monica...	*c*	71,036	0.33	
So. Pasadena ...	*c*	5,923	0.32	
Vallejo	*c*	18,155	0.50	
Venice	*c* 9,387	30,279	0.34	
COLORADO.				
Grand Junction..	*c*	1,800	0.35	
Leadville	*c a*	1,840	0.22	
Longmont	*c* 4,000	7,000	0.20	
Pueblo	*c*	36,500	0.32	
CONNECTICUT.				
Hartford	*gc* 63,000	63,000	0.93*c*	
Hartford	.....	.....	1.05*a*	
Meriden	*c*	12,375	0.47	
Meriden	*g*	17,078	0.40	
New Britain ...	*c* 14,000	13,164	0.32	
New Canaan	*c*	500	0.40	
Putnam	*c*	2,000	0.30	
Putnam	*g*.....	1,000	0.70	
Southington	*c*	5,250	0.38	
Wallingford	*c*	7,451	0.30	
DELAWARE.				
Wilmington	*gc* 20,000	.....	*p*	
FLORIDA.				
Bradentown	*c*	9,776	0.30	
Bradentown	*g*	40,000	0.41	
Dade City	*c*	600	0.30	
Gainesville	*c*	300	0.35	
Jacksonville	*c*	38,921	0.34	
Jacksonville	*g*	27,065	0.42	
DISTRICT OF COLUMBIA.				
Washington	*c*	9,000	0.30	
Washington	*g*	44,000	0.80	
GEORGIA.				
Atlanta	*g*	67,462	0.36	
Dublin	*c* 14,000	2,000	0.25	
Macon	*g*	32,624	0.36	
Savannah	*c*	5,000	0.40	
IDAHO.				
Caldwell	*c* 3,000	2,360	0.35	

Gutters (cont.)

Meriden	*h*	7,920	0.09	
New Britain ...	*c* 16,000	14,000	0.42	
Putnam	*h a*	3,000	0.10	
Southington	*c*	500	0.36	
Wallingford	*c*	15,612	0.20	
DISTRICT OF COLUMBIA.				
Washington	*c*	8,800	....	
Washington	*h*	9,000	....	
Washington	*d*	13,000	....	
FLORIDA.				
Bradentown	*c*	3,200	0.26	
Jacksonville	*c*	7,212	0.22	
Jacksonville	*d*	31,680	0.38	
GEORGIA.				
Atlanta	*h*	87,030	0.07	
ILLINOIS.				
Alton	*c*	9,101	0.51	
E. St. Louis....	*c*	9,721	0.65	
E. St. Louis....	*v*	1,411	0.54	
Herrin	*c*	8,670	0.71	
Marion	*c*	16,514	0.54	
Ottawa	*c*	2,400	0.30	
Taylorville	*c a*	2,881	0.40	
INDIANA.				
Elkhart	*c* 80	450	0.40	
Greencastle	*c*	4,200	0.60	
Lebanon	*c*	16,263	0.20	
IOWA.				
Belle Plaine	*c* 18,500	.....	0.32	
Boone	*c* 1,000	2,000	0.41	
Dubuque	*d*	460	0.36	
Ft. Dodge	*c*	29,098	0.58	
Ft. Dodge	*s*	2,115	0.68	
Marengo	*c*	200	0.22	
Oskaloosa	*c*	1,024	0.40	
KANSAS.				
Abilene	*c* 2,600	3,160	0.40	
Dodge City	*c* 200	280	0.30	
Hutchinson	*c* 16,840	4,000	0.20	
Manhattan	*c*	14,339	0.15	
Neodesha	*c* 500	1,000	0.25	
Salina	*c* 15,000	14,200	0.27	

Sidewalks (cont.)

Chicago	c		10,984,000	1.08
Chicago	e		329,000	0.35
Chicago Heights.	c	10,000	1,000	1.08
Cicero	c		23,502	1.23
Decatur	c	10,000	15,000	0.99
E. St. Louis.	c		6,757	1.35
Granite City.	c		35,000	1.16
Lyons	c		555	1.26
Murphysboro	c	20,221	3,600	1.17
Oak Park.	c	31,055	4,181	1.26
Ottawa	c		10,000	1.35
Rock Island.	c		25,400	1.26
Springfield	c	p	58,000	0.99
Spring Valley	c		2,666	1.35
Taylorville	c	a	2,790	1.41
Waukegan	c	2,800	2,907	1.30
INDIANA.				
Anderson	c	1,760	2,680	0.90
Connersville	c		500	0.90
Crawfordsville	c	20,533	3,224	0.84
Decatur	h	6,700	42,600	0.18
Elkhart	c	4,560	5,415	0.82
Evansville	p			
Fort Wayne.	c		49,597	1.26
Frankfort	c	4,555	6,650	0.72
Gary	c	4,143	32,570	1.03
Greencastle	c	10,500	1,800	1.10
Huntington	c	1,000	6,780	1.06
Lafayette	c		2,521	0.77
Laporte	c		1,800	0.81
Lebanon	c		577	0.90
Logansport	c	2,000	2,200	0.90
Muncie	c	3,333	6,870	0.94
Newcastle	c		8,950	0.90
Noblesville	c		7,247	0.33
Portland	c	500	905	0.90
Richmond	c	19,000	19,484	0.88
Seymour	c		400	0.90
Shelbyville	c		6,000	0.99
South Bend.	c		8,592	0.77
Vincennes	c	3,500	12,887	0.90
Vincennes	b		1,294	1.80
Washington	c	10,000	12,000	0.90
IOWA.				
Boone	c	2,000	3,000	1.08
Cedar Falls.	c	5,000	8,600	0.81
Cedar Rapids.	c	35,000	35,200	0.97
Clinton	c		4,540	1.17
Council Bluffs.	c	26,926	16,136	1.25
Creston	c		4,450	0.97
Creston	b		570	
Des Moines.	bc		148,773	0.97
Fort Madison.	p			0.90
Grinnell	c		900	
Marengo	c	7,000	900	0 81
Marshalltown	c		5,850	0.97
Missouri Valley.	c		2,000	0.90
Muscatine	c		6,160	1.00
Oskaloosa	c		167,000	0.99
Perry	c		2,222	0.81
Waterloo	c	9,200	16,700	0.90
KANSAS.				
Abilene	c	700	500	0.90
Coffeyville	c	13,000	1,666	0.90
Dodge City.	c	1,000	900	0.80
Hutchinson	c	11,700	14,600	0.72
Junction City.	c		2,222	0.95
Kansas City	c		6,800	0.95
Manhattan	c		14,289	0.80
Manhattan	b		2,779	0.76
Neodesha	c		1,100	0.90
Newton	c	50,000	15,000	0.90
Ottawa	c		8,000	0.75
Salina	c	2,500	2,800	0.80
Topeka	c	11,000	7,050	0.85
KENTUCKY.				
Louisville	c		9,508	0.89
Louisville	b		1,355	0.89
Morganfield	c		2,700	1.20
Paducah	c		16,283	0.99
Pikeville	c	2,000	204	3.06
LOUISIANA.				
Kentwood	c		100	
Lake Charles.	c		1,945	1.17
Shreveport	c		28,000	0.70
MAINE.				
Augusta	c		1,115	1.50
Bangor	c		526	2.30
Bangor	k		24,345	0.84
Biddeford	c		3,000	1.00
Portland	c	a	6,025	0.87
Portland	b	a	998	1.70
S. Portland.	c		3,565	0.90
Westbrook	k		600	0.65
MARYLAND.				
Frederick	c		4,000	0.90
MASSACHUSETTS.				
Boston	c		72,660	1.50
Boston	b		8,503	1.00
Boston	u		7,509	0.50
Brookline	k	6,000	8,000	1.80
Brookline	c	5,000		
Brookline	v	5,500	2,780	0.54
Dudley	c		26,745	1.85
E. Hampton.	c		1,220	1.26
Everett	c		6,300	1.71
Framingham	k		1,314	0.31
Greenfield	k	2,500	2,000	0.40

Curbs (cont.)

Nampa	c	a	850	0.39
Twin Falls	c		800	0.45
ILLINOIS.				
Alton	s	1,000	1,552	0.54
Bloomington	c		20,436	0.53
Champaign	c		25,149	0.50
Chicago	c		583,687	0.72
Chicago Heights.	c	8,481	33,000	0.60
Decatur	s	18,200		0.44
Delavan	c		15,000	0.25
E. St. Louis.	c		251	0.40
Granite City	c		35,000	0.13
Herrin	s	4,458	9,848	0.71
Hillsboro	c		8,000	0.35
Lyons	c		9,000	0.38
Moline	c		47,955	0.45
Oak Park	c		8,300	
Robinson	c	5,000		0.35
Spring Valley	c		3,020	0.52
Taylorville	c		8,900	0.44
INDIANA.				
Anderson	c	40,500	13,200	0.30
Crawfordsville	sc		380	0.21
Decatur	s		11,693	0.55
Elkhart	c	830	1,792	0.40
Frankfort	c	7,200	12,969	0.22
Gary	c	6,737	30,380	0.40
Greencastle	c		4,200	0.40
Huntington	c	5,000	5,100	0.47
Huntington	s	1,512	998	0.50
Lebanon	c		16,263	0.20
Noblesville	c		7,672	0.25
Portland	c	12,000	880	0.25
South Bend	c		9,687	0.18
Vincennes	s		11,000	0.45
IOWA.				
Boone	c	3,300	6,000	0.39
Creston	c		362	0.18
Des Moines	c		113,013	0.32
Dubuque	c	9,050	8,162	0.58
Emmettsburg	c	18,500		0.42
Marengo	c	650	800	0.30
Marshalltown	c		875	0.34
Oskaloosa	c		1,404	0.30
Sioux City	c		36,450	0.37
KANSAS.				
Abilene	c	900	1,100	0.30
Atchison	c	1,000	3,000	0.38
Chanute	c		10,000	0.50
Dodge City	c	500	2,180	0.22
Hutchinson	c	26,400	26,400	0.30
Iola	c		13,385	0.41
Kansas City	c		67,988	0.35
Manhattan	c		14,275	0.20
Neodesha	c	500	1,000	0.45
Parsons	s		300	0.60
Salina	c	15,000	14,200	0.28
KENTUCKY.				
Louisville	s		64,338	1.12
Louisville	c		13,383	0.30
Paducah	c		19,966	0.76
LOUISIANA.				
Kentwood			90	
New Orleans	c	95,000	71,044	0.65
Shreveport	c		20,000	0.38
MAINE.				
Augusta	c		634	0.74
Bangor	g		2,786	
Biddeford	c		7,200	0.30
Portland	g		5,421	p
MARYLAND.				
Baltimore	ds	64,000		0.37
Baltimore	e	119,010		0.51
MASSACHUSETTS.				
Boston	g		91,234	0.90
Brookline	g	3,000	3,260	0.80
Cambridge	g		5,733	
Dudley	g		2,500	0.85
Easthampton	g		2,150	0.83
Everett	g		6,323	0.95
Framingham	c		2,544	0.67
Haverhill	g		2,866	0.70
Holyoke	g		11,388	0.50
Lawrence	g	20,000	26,974	
Lawrence	c		628	0.44
Lowell	g	5,000	4,126	0.60
Lynn	c		21,037	0.50
Lynn	g		13,667	1.00
Medford	g		22,032	1.00
New Bedford	g		17,342	
Newton	g		1,044	1.20
Peabody	g	2,000	2,340	1.00
Revere	g	2,800	6,000	1.00
Somerville	g		23,102	0.93
Springfield	g		35,763	0.58
Springfield	c		3,279	
Waltham	g		4,119	0.90
Watertown	g		1,229	1.00
Westfield	c	1,000	1,284	0.70
Woburn	g	500	3,603	0.80
Worcester	g		11,876	0.83
Worcester	c		682	0.53
MICHIGAN.				
Benton Harbor.	c		17,000	0.34
Boyne City	c		1,200	0.35
Flint	c		35,259	0.35

Gutters (cont.)

Topeka	c		1,500	0.40
KENTUCKY.				
Paducah	c		19,899	0.25
LOUISIANA.				
Lake Charles	c		26,400	0.30
New Orleans	d	95,000	71,044	0.51
MAINE.				
Portland	hd		4,832	0.16
MASSACHUSETTS.				
Boston	g		108,000	0.46
Cambridge	g		5,733	
Dudley	h		4,998	0.21
Framingham	c		1,000	0.22
Haverhill	h		2,814	0.40
New Bedford	h		120,000	
Newton	h		2,196	0.15
Somerville	g		2,047	
Somerville	c		40,650	
Worcester	g		8,202	0.32
Worcester	c		1,891	0.24
Worcester	h		15,734	0.18
MICHIGAN.				
Grand Rapids	d	54,516	28,950	0.20
Manistee	h		28	0.20
Saginaw	dq	14,481	28,277	0.59
MINNESOTA.				
Duluth	c		2,814	0.75
Faribault	c		4,775	0.15
Red Wing	c		3,200	0.30
MISSISSIPPI.				
Laurel	c		2,260	0.64
MISSOURI.				
Cape Girardeau.	c		800	0.25
Kansas City	c	15,000	9,920	0.44
MONTANA.				
Billings	c		8,280	0.31
Great Falls	c		1,800	0.24
NEBRASKA.				
Alliance	c	1,200		0.40
Grand Island	c		440	0.29
Omaha	cu		1,328	0.48
Omaha	cr		3,809	0.32
Red Cloud	c		300	0.50
S. Omaha	c		14,880	0.23
NEW HAMPSHIRE.				
Leconia	g	2,000	1,000	0.90
NEW JERSEY.				
Atlantic City	d	6,560	46,965	0.77
Bloomfield	n		610	0.25
East Orange	g		2,217	0.27
Garfield	c		7,830	
Hackensack	c		3,834	0.18
Irvington	g		80,238	0.20
Montclair	h	500	334	0.30
Ocean City	c		4,500	0.19
Ocean City	d		2,700	0.35
Passaic	c	14,532	7,086	0.25
Plainfield	p			
Ridgewood	c	a	5,920	0.50
Summit	h	6,000	3,000	0.19
Trenton	c		24,201	0.19
NEW MEXICO.				
Roswell	c	9,704	7,100	0.40
NEW YORK				
Albany	g		3,700	0.23
Auburn	c		8,300	0.75
Binghamton	c		2,126	0.60
Corning	c		12,175	0.64
Herkimer	c		500	0.70
New York—				
Richmond	g		10,842	0.24
Richmond	d		27,258	0.28
Oneonta	c		50	0.22
Utica	c		22,800	0.47
NORTH CAROLINA.				
Asheville	c		6,133	0.14
Greensboro	c	8,000		0.30
NORTH DAKOTA.				
Mismarck	c		174	0.20
OHIO.				
Ashtabula	c		2,639	0.42
Chillicothe	c	3,250	5,250	0.24
Dayton	c		178,020	0.59
Massillon	c		12,000	0.30
Middletown	c	2,100	788	0.17
Troy	c		16,000	0.10
OKLAHOMA.				
Bartlesville	c		12	0.62
OREGON.				
Eugene	c		800	0.45
PENNSYLVANIA.				
Ben Avon	c		2,000	0.35
Bethlehem	c		400	0.50
Bloomsburg	d	1,700	500	0.18
Columbia	c		4,800	0.35
Corry	c		928	0.30
Freeland	c	3,900	2,000	0.63
Hanover	c		6,250	0.20
Hazleton	e		3,600	0.35
Lansdowne	d	10,000	30,000	0.73
Newcastle	c		2,000	0.55
S. Bethlehem	c		7,572	0.30

Sidewalks (cont.)

Greenfield	c	1,000	.....	...
Haverhill	c	.....	1,571	1.50
Haverhill	k	.....	4,404	0.50
Holyoke	c	.....	10,530	0.99
Lawrence	c	.....	6,227	1.03
Lawrence	k	.....	9,200	0.45
Lowell	c	1,500	648	1.63
Lowell	k	10,000	10,961	0.52
Lynn	c	.....	16,727	1.50
Lynn	k	.....	1,586	...
Medford	c	.....	849	1.60
Medford	b	.....	336	1.10
New Bedford	c	.....	8,703	0.90
Newton	k	.....	9,867	0.68
Peabody	k	2,000	2,144	0.50
Peabody	x	150	164	0.75
Revere	c	4,800	2,962	1.38
Somerville	c	.....	25,240	1.42
Springfield	c	.....	14,308	1.34
Springfield	b	.....	202	1.36
Stoughton	c	.....	900	1.75
Waltham	k	.....	2,994	0.38
Watertown	c	.....	1,200	1.44
Watertown	k	.....	3,000	0.70
Webster	c	.....	2,454	...
Westfield	c	6,000	4,086	1.00
Woburn	c	110	3,025	0.70
Woburn	k	280	.....	...
Worcester	c	.....	10,321	1.55
MICHIGAN.				
Alpena	c	1,660	1,722	0.72
Battle Creek	c	.....	33,625	0.73
Bay City	c	.....	48,543	0.86
Benton Harbor	c	2,200	1,700	...
Detroit	c	.....	82,284	1.08
Flint	c	25,000	30,600	0.82
Grand Rapids	c	32,540	18,137	0.75
Highland Park	c	25,000	21,300	1.08
Hinsdale	c	.....	720	0.72
Ludington	c	.....	5,000	0.67
Manistee	c	.....	3,850	1.08
Menominee	c	a	9,680	0.81
Monroe	c	a	1,200	0.81
Negaunee	c	.....	700	0.99
Niles	p	.....	.....	...
Norway	c	.....	2,225	0.72
Port Huron	c	2,500	444	0.83
Saginaw	c	30,000	o	0.90
South Haven	c	.....	636	0.68
Sturgis	c	3,500	4,106	0.72
Traverse City	c	.....	1,096	0.68
MINNESOTA.				
Austin	c	7,800	9,000	0.81
Chisholm	c	.....	36,624	1.27
Crookston	c	10,000	3,430	0.72
Duluth	c	9,500	23,000	1.05
Eveleth	c	.....	2,401	1.71
Faribault	c	.....	2,353	0.85
Hibbing	c	.....	1,400	1.21
Mankato	c	40,000	44,586	0.75
Minneapolis	d	202,300	162,708	0.75
Owatonna	c	.....	4,583	0.75
Red Wing	c	.....	1,330	0.99
Rochester	c	4,000	3,760	0.88
St. Cloud	c	.....	5,475	0.75
St. Paul	d	90,000	57,366	0.63
Stillwater	c	.....	410	0.81
Virginia	c	.....	14,361	1.31
Winona	c	1,625	23,767	0.86
MISSISSIPPI.				
Clarksdale	c	800	1,100	1.26
Columbus	c	.....	222	0.90
Hattiesburg	c	800	833	0.90
Jackson	c	.....	1,600	0.80
Laurel	c	6,000	2,800	1.10
Meridian	c	.....	2,470	0.90
Vicksburg	c	.....	2,250	1.22
MISSOURI.				
Brookfield	c	.....	15,840	1.26
Cape Girardeau	c	4,000	3,450	1.00
Carthage	s	2,200	2,500	1.10
Carthage	b	1,675	.....	...
Chillicothe	c	.....	30,000	1.04
Columbia	c	1,083	2,058	1.00
Excelsior Spr'gs.	c	.....	370	1.13
Fulton	c	.....	1,000	1.00
Independence	c	.....	5,800	0.99
Kansas City	c	65,000	77,830	1.11
Milan	c	.....	800	2.25
St. Charles	c	.....	2,233	2.35
Sedalia	c	10,000	4,700	1.00
University City	c	3,971	10,870	1.17
Windsor	c	2,000	2,000	1.00
MONTANA.				
Billings	c	2,800	11,840	1.17
Bozeman	c	12,000	11,000	1.40
Dillon	c	3,000	1,000	1.35
Great Falls	c	3,300	59,160	1.06
Missoula	c	.....	3,063	1.33
NEBRASKA.				
Fremont	c	.....	5,000	0.75
Lincoln	c	17,600	22,629	1.08
Lincoln	b	.....	323	0.81
Norfolk	c	5,000	4,500	0.90
Omaha	c	55,000	7,719	1.03
Omaha	b	2,800	1,629	0.98
Red Cloud	c	500	452	2.21
Seward	c	a	2,500	1.35

Curbs (cont.)

Flint	s	44,410	689	0.47
Grand Rapids	c	10,122	19,960	0.30
Highland Park	c	60,000	65,800	0.34
Hinsdale	c	.....	8,700	0.30
Manistee	c	.....	635	0.35
Negaunee	c	.....	2,640	0.24
Norway	c	.....	3,225	0.10
Port Huron	c	10,000	11,959	0.28
Saginaw	s	14,000	14,200	0.60
Saginaw	c	.....	7,500	0.45
So. Haven	c	.....	975	0.23
MINNESOTA.				
Austin	c	42,000	34,533	0.40
Chisholm	c	.....	22,451	0.55
Crookston	c	.....	200	0.30
Duluth	c	.....	53,097	0.55
Eveleth	c	.....	5,108	0.75
Faribault	c	.....	6,636	0.40
Minneapolis	g	.....	4,600	0.90
New Ulm	c	.....	3,875	0.38
Owatonna	c	.....	5,634	0.35
Red Wing	c	.....	3,900	0.30
Rochester	c	.....	7,790	0.32
St. Cloud	c	20,000	42,460	0.24
St. Paul	c	40,000	35,000	0.32
Stillwater	c	.....	431	0.30
Winona	c	3,228	8,326	0.36
MISSISSIPPI.				
Jackson	c	.....	500	0.28
MISSOURI.				
Brookfield	c	.....	3,960	0.34
Cape Girardeau	c	10,000	17,033	0.25
Chillicothe	c	.....	21,300	0.35
Columbia	c	2,231	5,803	0.29
Excelsior Spgs.	c	.....	1,000	0.34
Independence	c	.....	4,000	0.32
Kansas City	c	200,000	230,150	0.35
Mexico	c	.....	2,328	0.35
Sedalia	c	10,540	2,640	0.35
University City	c	1,280	4,916	0.50
Windsor	c	1,000	.....	....
MONTANA.				
Billings	c	10,000	3,430	0.40
Bozeman	c	10,000	14,450	0.48
Dillon	c	a	1,000	0.50
Great Falls	c	4,500	136,400	0.40
Missoula	c	.....	706	0.38
NEBRASKA.				
Alliance	c	18,000	4,000	0.33
Fremont	c	.....	5,280	0.25
Grand Island	c	.....	5,280	0.25
Hastings	s	.....	532	0.49
Lincoln	c	.....	13,188	0.52
Norfolk	c	17,000	.....	0.30
Omaha	c	.....	1,376	0.46
Omaha	s	.....	20,378	0.79
Red Cloud	c	500	600	0.35
So. Omaha	c	.....	53,746	0.39
NEW HAMPSHIRE.				
Laconia	g	2,000	1,000	0.90
Portsmouth	g	.....	400	1.00
Portsmouth	c	.....	2,718	0.65
NEW JERSEY.				
Atlantic City	g	9,870	26,240	1.10
Bayonne	s	.....	8,180	1.03
Bloomfield	s	20,000	30,495	0.43
Bloomfield	c	.....	4,398	0.50
Boonton	s	.....	10,560	....
Boonton	c	.....	1,000	....
Camden	s	.....	5,000	0.56
Camden	c	.....	4,000	0.44
E. Orange	s	.....	6,500	0.45
Garfield	c	.....	26,260	....
Hackensack	c	.....	13,575	0.31
Irvington	s	.....	15,277	1.00
Irvington	c	.....	4,950	0.60
Jersey City	g	.....	11,244	1.19
Jersey City	c	.....	1,501	0.60
Long Branch	c	.....	20,000	0.25
Montclair	c	20,000	10,000	0.75
Newark	g	.....	33,000	1.17
Newark	s	.....	90,000	0.80
Ocean City	c	.....	12,000	0.29
Ocean City	s	.....	400	0.40
Passaic	c	5,450	3,871	0.38
Ridgwood	c	.....	2,850	0.35
Summit	c	500	250	0.50
Trenton	c	1,800	1,760	0.39
Ventnor City	c	1,200	1,500	0.30
W. Hoboken	s	.....	2,100	0.60
W. New York	s	10,000	10,500	0.70
NEW MEXICO.				
Albuquerque	c	.....	3,600	0.50
Roswell	c	.....	7,100	0.19
NEW YORK.				
Albany	c	a	36,592	0.72
Albany	g	a	62,291	0.93
Auburn	s	.....	305	0.96
Auburn	c	880	.....	0.75
Binghamtoa	s	1,500	1,476	....
Binghamton	c	2,000	2,136	0.45
Clyde	c	.....	680	0.38
Corning	c	360	16,234	0.35
Cortland	s	.....	4,500	1.10
Elmira	s	a	5,600	0.88
Elmira	c	a	2,900	0.53
Freeport	c	.....	500	....

Gutters (cont.)

RHODE ISLAND.				
Pawtucket	h	a	4,800	....
SOUTH CAROLINA.				
Greenville	c	60,000	.....	0.17
SOUTH DAKOTA.				
Watertown	c	.....	7,550	0.36
TENNESSEE.				
Clarksville	c	.....	10,793	0.34
Johnson City	c	.....	13,040	0.24
Memphis	c	.....	41,100	0.21
Nashville	c	93,300	133,000	0.23
TEXAS.				
Dallas	c	.....	74,628	....
Denison	c	.....	7,032	0.25
Hillsboro	c	.....	18,500	0.25
Taylor	c	.....	6,000	0.30
Waxahachie	c	.....	15,141	0.30
UTAH.				
Logan	c	.....	13,000	0.44
VIRGINIA.				
Bristol	c	.....	5,000	0.33
Newport News	s	.....	27,482	....
WASHINGTON.				
Aberdeen	c	.....	7,250	0.45
Everett	c	10,000	21,857	0.28
No. Yakima	c	.....	1,516	0.85
Spokane	d	11,350	.....	....
Vancouver	c	.....	685	0.28
WEST VIRGINIA.				
Moundsville	c	.....	594	0.52
WISCONSIN.				
Chippewa Falls	c	.....	8,000	0.25
Eau Claire	c	.....	3,700	0.17
Janesville	c	.....	21,500	0.40
Lake Geneva	c	.....	440	0.23
Milwaukee	d	70,200	92,997	0.51
Oshkosh	c	.....	21,725	0.53
Sheboygan	c	.....	74	0.40
Sheboygan	d	3,900	.....	....
Wausau	c	.....	4,000	0.25
WYOMING.				
Cheyenne	c	.....	4,394	0.18
CANADA.				
Vancouver, B. C.	c	.....	23,285	0.32
Kingston, Ont.	c	.....	5,525	0.30

a—Amount indefinite.
b—Basalt block.
c—Cement concrete.
d—Vitrified brick or block.
e—Flagstone.
g—Granite.
h—Cobblestone.
k—Crushed stone.
n—Trap block.
o—Length included with concrete gutter.
p—Work done by property owners.

Gutters are assumed 18 inches wide, except those marked as follows:

q—Gutter, 36 inches wide.
r—Gutter, 32 inches wide.
s—Gutter, 30 inches wide.
u—Gutter, 24 inches wide.
v—Gutter, 12 inches wide.
x—Crosswalks.
y—Reinforced.
z—Relaid.

Concrete Comb'd Curb and Gutter

City.	Proposed for 1915.	Constructed in 1914.	Cost per Lin. Ft.
ALABAMA.			
Birmingham	.....	521,209	$0.75
ARKANSAS.			
De Queen	.....	500	0.65
Ft. Smith	.....	88,640	0.35
Pine Bluff	.....	5,090	0.55
CALIFORNIA.			
Colusa	a	4,850	0.78
Los Gatos	21,000	19,885	0.20
Venice	.....	.....	....
COLORADO.			
Boulder	.....	1,361	0.55
Pueblo	101,000	.....	0.45
CONNECTICUT.			
Hartford	1,400	1,400	0.85
New Britain	2,000	1,535	0.72
Rockville	.....	2,850	0.74
FLORIDA.			
Bradentown	.....	13,500	0.50
Port Tampa	.....	11,195	0.51
Sarasota	.....	10,560	0.50
GEORGIA.			
Americus	13,000	3,200	0.50

Sidewalks (cont.)

South Omaha...	c	a	16,000	0.90
South Omaha...	b	a	6,000	0.81
York	c	.....	10,000	1.26
NEW HAMPSHIRE.				
Berlin	c	.....	300	1.46
Berlin	k	.....	800	0.70
Laconia	k	2,000	2,000	0.60
Portsmouth	c	.....	546	2.68
NEW JERSEY.				
Bayonne	c	1,000	999	1.71
Bayonne	s	.....	151	2.43
Bloomfield	c	50,000	.....	...
Boonton	c	.....	1,000	...
Boonton	s	.....	7,040	...
Camden	c	.....	2,000	0.99
E. Orange	c	.....	1,000	1.10
Garfield	c	.....	13,280	0.98
Hackensack	c	.....	4,929	1.08
Irvington	c	.....	1,846	1.26
Irvington	s	.....	3,124	1.35
Jersey City	c	.....	3,513	1.38
Jersey City	s	.....	962	1.59
Long Branch	c	.....	4,000	1.35
Montclair	c	20,000	10,000	1.35
Newark	c	.....	20,000	1.62
Newark	s	.....	3,300	1.62
Ocean City	c	.....	6,000	1.00
Passaic	c	2,800	1,408	1.12
Ridgewood	p	.....	1,700	1.26
Rutherford	c	900	4,600	1.08
Summit	c	2,000	800	1.10
Trenton	c	500	2,047	0.98
Ventnor City	c	800	900	1.08
Westfield	c	5,800	2,900	0.90
Westfield	s	.....	610	1.26
West Hoboken	c	.....	604	1.53
West Hoboken	s	.....	322	1.53
West New York	c	4,000	3,080	1.44
West New York	s	2,000	2,280	1.44
West Orange	c	.....	3,000	0.90
NEW MEXICO.				
Albuquerque	c	.....	3,655	1.32
NEW YORK.				
Albany	c	.....	91,675	1.71
Albany	s	.....	2,833	1.89
Auburn	c	7,000	7,000	1.08
Binghamton	c	.....	15,720	0.99
Binghamton	s	.....	32	1.35
Buffalo	c	.....	70,586	0.99
Clyde	c	1,000	1,826	1.15
Corning	h	.....	3,012	0.22
Corning	c	1,660	.....	...
Cortland	c	1,500	1,100	0.90
Elmira	c	13,000	13,355	0.97
Freeport	c	.....	2,000	...
Fulton	c	.....	3,000	0.90
Gloversville	c	.....	2,130	1.20
Herkimer	c	.....	3,624	1.08
Hudson	c	5,900	3,000	1.26
Hudson	s	.....	2,770	0.81
Johnstown	c	.....	1,515	0.99
Little Falls	c	.....	5,500	1.35
Lockport	c	.....	2,667	1.35
Mamaroneck	c	.....	653	1.49
Newark	c	2,000	2,000	0.99
New York City—				
Bronx Boro	s	43,500	12,340	2.25
Bronx Boro	c	3,340	34,290	1.35
Brooklyn Boro	c	60,000	51,878	1.26
Queens Boro	s	.....	8,750	2.25
Queens Boro	c	.....	40,860	1.35
Richm'nd Boro	s	.....	158	...
Richm'nd Boro	c	.....	1,397	...
Niagara Falls	c	.....	8,000	1.08
Norwich	s	.....	p	1.08
Ogdensburg	c	.....	4,463	0.86
Oneonta	c	1,000	13,041	1.38
Oswego	c	850	1,000	1.08
Poughkeepsie	c	.....	6,504	1.35
Salamanca	c	.....	2,024	1.08
Schenectady	c	8,000	10,100	0.81
Sidney	c	.....	500	0.95
Solvay	c	.....	9,710	1.10
Syracuse	c	30,000	26,700	0.86
Utica	c	12,500	14,200	1.44
Watertown	c	.....	10,000	1.08
Westfield	c	.....	100	0.90
NORTH CAROLINA.				
Asheville	c	.....	13,325	1.34
Charlotte	c	7,500	8,724	1.00
Durham	c	a	2,045	1.04
Gastonia	c	.....	31,446	0.89
Goldsboro	g	.....	2,780	0.50
Greensboro	c	15,000	10,000	1.10
Raleigh	c	.....	10,000	1.09
Roanoke Rapids	c	8,000	1,000	1.15
NORTH DAKOTA.				
Bismarck	c	800	1,800	1.26
Fargo	c	.....	8,000	1.06
Grand Forks	c	3,000	3,000	1.00
Jamestown	c	2,000	1,740	1.17
OHIO.				
Ada	c	2,000	2,400	0.90
Akron	c	41,680	54,368	1.13
Barberton	c	.....	200	0.90
Bucyrus	c	.....	1,780	0.90
Bucyrus	s	.....	5,500	1.08
Cambridge	c	4,000p	10,000	1.17

Curbs (cont.)

Fulton	c	.....	2,883	0.50
Gloversville	c	.....	2,217	0.32
Herkimer	s	.....	1,350	0.90
Hudson	c	5,280	7,000	0.30
Ilion	s	.....	2,800	0.63
Ilion	c	.....	10,000	0.45
Johnstown	g	.....	2,000	0.55
Johnstown	c	.....	7,552	0.60
Little Falls	s	.....	1,000	1.00
Little Falls	c	.....	5,500	0.54
Mamaroneck	c	.....	1,483	0.53
Newark	c	.....	1,500	0.60
New York—				
Bronx	s	92,600	107,890	0.77
Brooklyn	s	90,000	84,800	1.02
Brooklyn	c	.....	65,425	0.41
Brooklyn	c	120,000	36,580	0.56
Queens	c	.....	65,139	0.65
Richmond	s	.....	5,188	0.81
Richmond	c	.....	552	0.45
Niagara Falls	s	.....	40,000	0.75
Ogdensburg	c	.....	1,300	0.35
Olean	s	.....	2,900	0.60
Olean	c	.....	2,850	0.50
Oneonta	s	.....	50	0.70
Oswego	s	1,020	1,347	0.89
Plattsburg	c	.....	3,075	0.60
Poughkeepsie	s	.....	17,270	0.83
Salamanca	c	.....	2,000	0.30
Schenectady	g	50,000	55,000	0.85
Schenectady	c	7,800	.....	....
Sidney	c	.....	100	0.75
Solvay	s	.....	4,542	0.85
Syracuse	s	120,000	94,370	0.89
Syracuse	c	5,000	.....	....
Utica	s	.....	3,100	0.85
NORTH CAROLINA.				
Asheville	c	.....	10,800	0.15
Charlotte	c	.....	3,064	0.30
Goldsboro	b	.....	2,000	0.17
Goldsboro	g	2,000	.....	....
Greensboro	g	15,000	10,000	0.15
NORTH DAKOTA.				
Bismarck	c	.....	4,760	0.52
Grand Forks	c	.....	23,000	0.35
Jamestown	c	8,700	.....	0.66
OHIO.				
Akron	s	78,180	79,031	0.48
Ashtabula	c	.....	2,280	0.30
Bellefontaine	c	.....	6,400	0.30
Chillicothe	c	3,100	7,800	0.30
Dayton	c	.....	27,194	0.50
Galion	c	.....	5,591	0.50
Greenville	s	1,000	.....	0.50
Lakewood	s	.....	40,400	0.45
Lorain	s	25,000	37,000	0.47
Marietta	c	.....	14,169	0.33
Marion	s	10,560	6,367	0.55
Massillon	c	.....	12,000	0.45
Mt. Vernon	s	3,100	5,009	0.55
Norwood	c	.....	3,200	0.50
Oberlin	s	1,925	5,640	0.35
Sandusky	c	.....	15,600	0.42
Springfield	c	.....	14,500	0.44
Steubenville	c	.....	1,800	0.30
Toledo	c	.....	36,275	0.86
Troy	c	4,000	15,864	0.30
Urbana	s	.....	6,000	0.60
Urbana	c	.....	1,500	0.55
Xenia	c	12,000	.....	....
OKLAHOMA.				
Bartlesville	c	.....	3,940	0.37
Chickasha	c	a	350	0.50
McAlester	c	8,000	.....	0.55
OREGON.				
Eugene	c	.....	2,040	0.35
Marshfield	c	5,300	6,000	0.51
Portland	c	95,568	131,649	0.35
Salem	c	.....	7,500	0.30
PENNSYLVANIA.				
Bethlehem	c	.....	300	0.90
Bloomsburg	c	4,700	500	0.40
Carlisle	c	p	6,171	0.35
Chambersburg		p	.....	....
Charleroi	c	p	8,200	0.70
Chester	c	.....	5,000	0.50
Columbia	c	.....	4,800	0.38
Connellsville	c	.....	2,191	0.47
Corry	c	.....	4,324	0.55
Donora	c	.....	6,500	0.76
Dubois	c	3,575	9,479	0.40
Farrell	c	.....	500	0.50
Farrell	s	.....	5,070	0.51
Freeland	c	3,100	2,000	0.48
Greensburg	s	6,800	7,012	0.66
Hanover	c	9,000	3,100	0.60
Harrisburg	gc	18,900	26,625	0.88
Hazleton	s	.....	1,000	1.00
Jeannette	c	.....	980	...
Juniata	c	.....	465	0.65
Juniata	s	89	.....	....
Lansdowne	s	10,000	30,000	0.60
Lansford	c	2,466	1,586	0.65
McKees Rocks	c	.....	380	0.88
Oil City	c	.....	916	0.15
Philadelphia	g	300	300	0.28

Curb and Gutter (cont.)

IDAHO.			
Caldwell	2,000	2,000	0.80
ILLINOIS.			
Aurora	.....	31,840	0.50
Chicago	.....	751,254	0.64
Chicago Heights	20,000	.....	0.50
Cicero	.....	79,606	0.49
Decatur	18,200	23,649	0.49
Galesburg	10,450	31,591	0.56
Granite City	5,400	6,000	0.90
Hillsboro	1,800	18,000	0.50
Hinsdale	.....	6,000	0.55
Lyons	.....	9,000	0.38
Murphysboro	.....	33,119	0.54
Newton	5,800	.....	0.45
Oak Park	63,047	115,264	0.58
Ottawa	.....	86,275	0.55
Pana	.....	23,760	0.52
Rockford	.....	67,784	0.45
Taylorville	a	41,139	0.50
Waukegan	.....	18,000	0.60
INDIANA.			
Connersville	.....	5,000	0.45
Crawfordsville	5,894	3,849	0.41
Elkhart	9,400	8,361	0.42
Evansville	.....	34,330	0.42
Frankfort	.....	594	0.38
Gary	4,895	22,560	0.55
Greencastle	10,600	.....	0.60
Lafayette	.....	9,240	0.46
Laporte	.....	2,810	0.45
Logansport	2,000	2,000	0.50
Muncie	2,554	3,126	0.48
Newcastle	.....	15,310	0.40
Portland	12,000	6,944	0.47
Richmond	10,000	22,186	0.60
Seymour	.....	4,800	0.41
Shelbyville	.....	3,000	0.55
Vincennes	.....	8,810	0.45
Washington	.....	5,120	0.39
IOWA.			
Algona	.....	30,017	0.58
Belle Plaine	.....	22,197	0.63
Boone	13,000	17,000	0.51
Cedar Falls	22,000	.....	0.50
Cedar Rapids	15,000	7,520	0.75
Council Bluffs	15,728	12,287	0.65
Dubuque	5,850	14,257	0.66
Forest City	22,000	.....	0.57
Ft. Madison	.....	2,434	0.48
Missouri Valley	8,000	12,000	0.63
Oskaloosa	.....	13,975	0.67
Pella	.....	2,650	0.60
Perry	12,780	.....	0.48
Sioux City	.....	9,662	0.70
Waterloo	9,900	47,611	0.60
KANSAS.			
Abilene	9,000	16,418	0.48
Arkansas City	15,840	.....	0.50
Atchison	2,000	4,000	0.65
Dodge City	5,000	7,700	0.43
Herrington	5,600	.....	0.53
Independence	.....	3,600	0.50
Junction City	.....	31,446	0.42
Neodesha	14,000	12,000	0.45
Newton	50,000	45,000	0.50
Ottawa	16,000	21,996	0.55
Parsons	.....	4,000	0.38
Pittsburg	.....	53,082	0.45
Salina	6,552	.....	0.52
Topeka	28,133	29,283	0.43
KENTUCKY.			
Morganfield	.....	4,300	0.58
LOUISIANA.			
Lake Charles	15,000	35,000	0.25
MARYLAND.			
Frederick	.....	14,209	0.70
MICHIGAN.			
Battle Creek	.....	14,847	0.38
Grand Rapids	58,100	30,615	0.40
Houghton	.....	1,100	0.45
Kalamazoo	11,150	2,133	0.50
Ludington	.....	10,350	0.33
Manistee	.....	2,456	0.37
Menominee	5,880	2,940	0.45
Saginaw	.....	500	0.62
Sturgis	11,000	11,500	0.43
Traverse City	.....	900	0.28
MINNESOTA.			
Crookston	.....	1,800	0.35
Hibbing	.....	1,034	0.58
Mankato	10,000	11,586	0.50
Minneapolis	316,800	379,000	0.34
Rochester	7,338	16,280	0.48
Virginia	.....	10,888	0.81
MISSISSIPPI.			
Clarksdale	4,000	5,000	0.50
Jackson	.....	1,200	0.40
Laurel	2,800	7,645	0.55
Vicksburg	.....	4,289	0.55
MISSOURI.			
Cape Girardeau	1,000	1,400	0.50
Chillicothe	.....	3,600	0.50
Columbia	787	1,417	0.75
Excelsior Springs	1,600	.....	0.80
Jefferson City	.....	44,569	0.75
Nevada	.....	15,000	0.35
St. Charles	.....	2,319	0.65

Sidewalks (cont.)

Chillicothe	*c*	850	2,700	0.72
Cleveland	*c*	100,000	92,206	1.06
Cleveland	*s*	140,000	126,356	1.08
Columbus	*c*	.....	23,500	1.25
Conneaut	*c*	.....	1,800	0.90
Dayton	*c*	4,450	12,675	0.90
Delaware	*c*	5,000	5,000	1.11
Galion	*s*	.....	1,000	1.12
Greenville	*c*	10,000	7,000	0.81
Hamilton	*c*	.....	5,860	0.95
Ironwood	*c*	.....	21,120	0.90
Lakewood	*s*	11,000	5,730	1.22
Lancaster	*c*	5,000	4,106	*p*
Lima	*c*	.....	9,504	1.02
Lorain	*s*	5,000	11,000	0.90
Mansfield	*c*	.....	930	1.82
Marion	*s*	5,500	6,800	1.44
Massillon	*c*	.....	555	0.90
Middletown	*c*	11,000	16,010	0.90
Mingo Junction	*c*	245	225	0.90
Mt. Vernon	*c*	800	400	0.80
Norwood	*c*	3,300	5,560	1.26
Painesville	*c*	18,000	21,505	0.90
Portsmouth	*c*	.....	7,884	1.00
Sandusky	*c*	.....	5,500	1.21
Sandusky	*s*	.....	1,270	1.32
Sidney	*c*	.....	280	0.72
Springfield	*c*	.....	12,000	0.99
Steubenville	*c*	.....	18,130	0.99
Toledo	*c*	.....	36,275	0.86
Toledo	*s*	.....	24,351	1.06
Troy	*c*	2,200	1,333	0.90
Wapakoneta	*c*	1,100	670	0.99
Washington C. H	*c*	.....	4,000	0.90
Willoughby	*c*	.....	800	0.90
Zanesville	*p*	.....	.....	...
OKLAHOMA.				
Bartlesville	*c*	5,000	4,900	0.97
Chickasha	*c*	*a*	200	1.13
Durant	*c*	1,470	1,470	0.90
Enid	*c*	550	550	1.08
Okmulgee	*c*	.....	3,300	1.08
Ponca City	*c*	*a*	2,500	0.72
Shawnee	*c*	.....	8,300	0.99
Tulsa	*c*	6,700	8,900	0.83
OREGON.				
Ashland	*c*	.....	500	1.15
Eugene	*c*	20,197	15,148	0.77
Hood River	*c*	100	850	0.80
Marshfield	*c*	12,000	8,500	1.35
Marshfield	*v*	.....	10.800	0.40
Portland	*c*	53,000	19,500	0.90
Salem	*c*	.....	35,000	0.90
PENNSYLVANIA.				
Beaver Falls	*c*	.....	2,400	0.80
Ben Avon	*c*	.....	5,000	1.49
Bethlehem	*c*	.....	3,000	1.35
Bloomsburg	*c*	2,150	1,850	0.90
Bradford	*pbc*	3,000	3,000	1.80
Carlisle	*c*	*p*	4,375	1.30
Chambersburg	*p*	.....	.....	...
Charleroi	*p*	.....	.....	...
Chester	*c*	.....	2,780	1.35
Coaldale	*c*	1,200	900	1.27
Coatesville	*c*	1,400	1,220	0.95
Columbia	*c*	.....	2,700	0.99
Corry	*c*	.....	900	...
Corry	*b*	.....	306	...
Corry	*s*	.....	271	...
Donora	*c*	.....	928	1.35
Erie	*c*	.....	57,500	1.08
Farrell	*c*	.....	250	1.26
Farrell	*s*	.....	300	1.26
Freeland	*c*	4,000	2,700	1.35
Hazleton	*c*	.....	2,800	1.44
Hazleton	*k*	.....	4,000	0.54
Indiana	*c*	.....	8,800	1.00
Juniata	*c*	2,100	1,766	...
Juniata	*b*	2,100	.....	...
Juniata	*s*	2,800	.....	...
Lansdowne	*c*	1,200	960	1.53
McKees Rocks	*c*	.....	28	1.44
Meadville	*c*	.....	6,600	...
North Braddock	*c*	300	503	1.35
Oil City	*c*	.....	660	1.49
Parkersburgh	*c*	.....	1,600	...
Philadelphia	*c*	3,000	3,000	1.35
Philadelphia	*b*	800	300	0.96
Philadelphia	*s*	50	100	0.60
Pittsburgh	*x*	.....	296,700	0.89
Pottsville	*c*	.....	1,345	1.35
Scottdale	*c*	.....	980	1.45
Scottdale	*s*	.....	1,270	1.60
Scranton	*c*	.....	74,200	0.96
South Bethlehem	*c*	.....	20	1.35
Tyrone	*c*	.....	1,660	1.25
Tyrone	*b*	.....	670	1.00
Uniontown	*c*	.....	2,000	1.60
Warren	*c*	.....	8,800	0.99
Waynesboro	*c*	.....	400	0.65
Wilkesbarre	*cs*	*a*	6,470	...
RHODE ISLAND.				
Pawtucket	*c*	*a*	4,155	1.65
Providence	*p*	.....	.....	...
SOUTH CAROLINA.				
Charleston	*c*	.....	20,060	0.89
Columbia	*c*	17,600	26,000	1.25
Greenville	*c*	20,000	.....	0.90
Spartanburg	*c*	.....	16,518	0.83

Curbs (cont.)

Philadelphia	*s*	1,500	3,200	0.11
Philadelphia	*c*	2,600	520	0.41
Pittsburg	*c*	30,000	130,000	0.83
Pottsville	*c*	.....	5,831	0.85
St. Marys	*c*	.....	5,000	0.75
Scottdale	*c*	.....	520	0.48
Scottdale	*s*	.....	3,320	0.65
Scranton	*s*	.....	48,423	0.80
S. Bethlehem	*c*	.....	45	0.25
Tyrone	*c*	.....	3,500	0.50
Warren	*c*	.....	1,868	....
Waynesboro	*c*	.....	10,998	0.35
Wilkes Barre	*cs*	56,864	43,451	0.78
RHODE ISLAND.				
Pawtucket	*g*	*a*	4,755	....
Providence	*g*	38,591	46,864	*p*
SOUTH CAROLINA.				
Charleston	*g*	.....	36,129	0.29
Columbia	*c*	26,400	58,080	0.30
Greenville	*g*	25,000	.....	0.35
Orangeburg	*g*	2,400	.....	0.36
Spartanburg	*g*	.....	7,984	0.30
Spartanburg	*c*	.....	974	0.25
SOUTH DAKOTA.				
Aberdeen	*c*	5,000	5,000	0.45
Mitchell	*c*	3,000	1,884	0.35
Sioux Falls	*c*	.....	10,012	0.32
Watertown	*c*	.....	7,550	0.36
Yankton	*c*	5,500	.....	0.38
TENNESSEE.				
Johnson City	*c*	.....	13,040	0.24
Memphis	*g*	.....	37,680	0.47
Nashville	*c*	10,000	36,000	0.25
TEXAS.				
Abilene	*c*	.....	18,000	0.25
Amarillo	*c*	1,500	.....	....
Austin	*c*	.....	35,785	....
Dallas	*c*	.....	97,730	....
Denison	*c*	.....	44,460	0.30
Greenville	*c*	.....	51,000	0.38
Hillsboro	*c*	.....	23,000	0.40
Marshall	*c*	.....	2,000	0.40
McKinney	*c*	.....	2,000	0.30
Taylor	*c*	.....	5,000	0.40
Waxahachie	*c*	.....	4,153	0.28
UTAH.				
Logan	*c*	.....	13,000	0.37
Ogden	*c*	1,900	490	0.74
VERMONT.				
Barre	*c*	.....	975	0.75
Rutland	*c*	1,200	.....	....
VIRGINIA.				
Danville	*g*	.....	1,400	0.60
WASHINGTON.				
Aberdeen	*c*	.....	7,250	0.30
Bellingham	*c*	.....	4,218	0.37
Everett	*c*	25,000	24,688	0.29
N. Yakima	*c*	.....	670	0.40
Seattle	*g*	.....	9,800	1.75
Seattle	*c*	63,360	175,000	0.30
Spokane	*c*	.....	52,272	0.32
Sunnyside	*c*	.....	3,900	0.31
Tacoma	*c*	.....	14,415	0.35
Tacoma	*e*	.....	2,165	0.55
Tacoma	*s*	.....	423	1.45
Vancouver	*c*	.....	10,726	0.30
Walla Walla	*c*	12,000	6,850	0.35
WEST VIRGINIA.				
Elkins	*c*	2,000	.....	1.00
Huntington	*c*	23,680	119,508	0.55
Moundsville	*c*	.....	4,966	0.25
WISCONSIN.				
Chippewa Falls	*c*	.....	8,000	0.25
Eau Claire	*c*	5,000	.....	0.20
Lake Geneva	*c*	440	5,875	0.50
Marinette	*c*	.....	6,885	0.33
Merrill	*c*	.....	2,000	....
Milwaukee	*s*	15,000	46,853	0.50
Milwaukee	*g*	20,000	.....	0.80
Sheboygan	*c*	.....	22,818	0.50
Sheboygan	*s*	.....	2,300	0.50
Waupaca	*c*	.....	4,900	0.20
Wausau	*c*	.....	4,000	0.25
WYOMING.				
Sheridan	*c*	36,000	21,120	0.40
CANADA.				
Vancouver, B. C.	*c*	.....	13,429	0.49
Victoria, B. C.	*c*	.....	50,806	0.41
Brantford, Ont.	*c*	.....	11,954	0.25
Chatham, Ont.	*c*	9,380	7,219	0.30
Kingston, Ont.	*c*	.....	900	0.30
London, Ont.	*c*	7,872	5,938	0.30
Oshawa, Ont.	*c*	2,700	1,800	0.35
Quebec, Que.	*g*	.....	1,512	1.00

a—Amount undetermined.
b—Wooden curb.
c—Cement concrete curb.
d—Redressed and reset granite curb.
e—Armored concrete curb.
g—Granite curb.
s—Sandstone or limestone curb.

Curb and Gutter (cont.)

Sedalia	5,280	.....	0.54
University City	.....	8,332	0.85
Windsor	2,000	.....	....
NEBRASKA.			
Alliance	4,500	.....	0.70
Grand Island	.....	440	0.50
Lincoln	.....	61,547	0.88
Omaha	.....	32,025	0.57
York	50,000	.....	0.91
NEW JERSEY.			
Bloomfield	10,000	.....	....
Montclair	6,000	4,000	0.99
Passaic	2,500	.....	0.66
Ridgewood	*a*	3,060	0.70
Rutherford	2,000	10,000	0.81
Westfield	.....	36,500	0.80
NEW YORK.			
Auburn	6,461	8,072	0.75
Binghamton	2,000	2,126	0.60
Clyde	1,600	1,760	0.41
Corning	.....	12,175	0.64
Fulton	.....	16,000	0.50
Little Falls	.....	1,600	0.75
Newark	7,000	.....	0.60
Norwich	.....	3,800	0.60
Oneonta	8,057	.....	0.64
Oswego	5,104	2,350	0.72
Poughkeepsie	.....	3,570	0.65
Schenectady	20,000	2,000	0.50
Solvay	.....	5,886	0.85
Watertown	.....	12,600	0.65
NORTH CAROLINA.			
Durham	.....	9,800	0.52
Raleigh	.....	10,000	0.63
NORTH DAKOTA.			
Bismarck	.....	1,310	0.76
OHIO.			
Akron	.....	18,731	0.50
Bellefontaine	1,760	.....	0.50
Conneaut	.....	1,500	0.51
Elyria	.....	10,500	0.57
Greenville	15,000	14,500	0.50
Hamilton	.....	16,250	0.50
Ironwood	.....	7,000	0.40
Lima	.....	12,800	0.45
Middletown	21,426	29,929	0.48
Mingo Junction	4,500	810	0.55
Mt. Vernon	.....	528	0.60
Norwood	13,100	67,000	0.56
Oberlin	.....	2,425	0.60
Painesville	13,218	378	0.50
Portsmouth	.....	44,000	0.40
Sandusky	.....	15,200	0.51
Sidney	.....	500	0.35
Steubenville	.....	16,260	0.54
OKLAHOMA.			
Bartlesville	6,000	2,350	0.59
McAlester	.....	1,340	0.55
Okmulgee	.....	1,830	0.64
Ponca City	10,000	4,400	0.50
OREGON.			
Eugene	6,300	5,000	0.65
Hood River	1,400	800	0.40
Marshfield	.....	5,500	0.90
PENNSYLVANIA.			
Athens	.....	4,000	0.50
Ben Avon	.....	10,000	0.72
Bradford	760	3,050	0.77
Catasauqua	.....	765	0.55
Coaldale	4,000	3,000	0.76
Coatesville	4,750	.....	....
Ellwood City	.....	6,824	0.48
Freeland	400	310	1.17
Greenville	.....	2,945	0.49
Hanover	.....	6,200	0.80
Lansdowne	10,000	30,000	1.32
Meadville	.....	39,218	0.47
North Braddock	5,000	10,500	0.73
Oil City	6,100	15,700	0.62
Parkesburg	.....	600	....
Uniontown	.....	17,000	0.53
W. Homestead	.....	975	....
SOUTH CAROLINA.			
Greenville	10,000	.....	0.40
SOUTH DAKOTA.			
Yankton	.....	500	0.90
TEXAS.			
Denison	.....	4,931	0.50
Greenville	.....	24,000	0.65
Longview	.....	2,700	0.70
McKinney	18,480	12,200	0.45
UTAH.			
Ogden	12,310	6,440	1.26
Salt Lake	20,000	155,000	0.90
VIRGINIA.			
Danville	.....	11,000	0.60
WASHINGTON.			
Bellingham	25,500	12,115	0.43
Olympia	10,868	23,043	0.60
Spokane	.....	17,530	0.50
WEST VIRGINIA.			
Bluefield	.....	31,000	0.58
Logan	.....	16,500	0.63
Moundsville	.....	594	0.52

Sidewalks (cont.)

SOUTH DAKOTA.				
Aberdeen	c	3,000	3,000	1.25
Lead	c	4,100	3,000	2.70
Lead	v	.....	375	0.60
Mitchell	c	4,000	3,860	0.95
Sioux Falls	c	1,700	4,500	0.99
Yankton	c	600	850	0.90
TENNESSEE.				
Clarksville	c	.....	7,200	1.13
Johnson City	c	.....	8,750	0.99
Memphis	c	.....	46,145	0.90
Nashville	c	25,000	50,000	1.10
TEXAS.				
Abilene	c	.....	550	0.72
Abilene	s	.....	390	0.60
Abilene	v	.....	8,600	0.20
Amarillo	c	1,589	.....	...
Austin	c	.....	16,615	0.99
Cuero	p	.....	.....	...
Dallas	c	.....	74,476	0.99
Denison	c	.....	4,051	0.99
Greenville	c	.....	36,000	1.17
Hillsboro	c	.....	4,000	...
Longview	c	o	4,000	1.17
Marshall	c	.....	2,500	1.08
McKinney	c	.....	2,000	1.08
Quanah	c	a	.....	...
Sulphur Springs	c	2,000	.....	1.08
Taylor	c	5,900	7,030	1.26
Waxahachie	c	.....	8,400	0.73
Waxahachie	h	.....	1,640	0.12
Waxahachie	b	.....	1,760	0.61
UTAH.				
Logan	c	9,500	13,400	0.84
Ogden	c	.....	7,140	1.41
Richfield	c	3,000	3,106	1.50
Salt Lake City	c	3,700	1,075,000	0.99
VERMONT.				
Barre	c	.....	3,022	1.03
Rutland	c	.....	865	1.30
VIRGINIA.				
Danville	c	.....	14,000	0.80
Suffolk	c	.....	10,000	0.81

(Cont. in 2d col.)

Sidewalks (cont. from 1st col.)

WASHINGTON.				
Aberdeen	c	10,000	10,905	0.77
Aberdeen	v	1,000	715	0.44
Bellingham	c	53,102	22,549	1.02
Bellingham	v	.....	18,205	0.08
Everett	c	15,000	17,476	0.87
North Yakima	c	.....	278	1.17
Olympia	c	6,660	16,372	0.80
Seattle	c	47,500	80,000	0.85
Spokane	c	11,700	20,924	0.90
Sunnyside	c	.....	3,000	1.17
Tacoma	c	.....	133,377	0.99
Vancouver	c	.....	7,136	0.77
Walla Walla	c	13,300	37,000	1.04
WEST VIRGINIA.				
Bluefield	c	.....	14,444	1.71
Elkins	p	.....	.....	...
Moundsville	c	.....	2,800	1.13
WISCONSIN.				
Antigo	c	5,000	2,783	0.99
Appleton	c	10,000	16,296	1.17
Chippewa Falls	c	.....	1,670	0.72
Columbus	c	1,000	1,240	0.90
Green Bay	c	20,000	18,679	1.08
Janesville	c	.....	2,700	...
Lake Geneva	c	1,000	2,500	0.99
Madison	c	4,000	4,000	1.08
Marinette	c	.....	7,040	0.81
Merrill	c	.....	6,700	1.00
Milwaukee	c	70,500	70,640	0.97
Sheboygan	c	1,330	11,020	0.66
Superior	c	30,000	30,721	1.10
Waupaca	c	.....	2,277	0.63
Wausau	c	11,700	12,917	0.83
West Allis	c	10,000	9,262	0.99
WYOMING.				
Cheyenne	c	.....	2,200	1.04
Sheridan	c	2,000	880	1.44
CANADA.				
Prince Rupert, B. C.	v	9,000	1,000	0.70
Vancouver, B. C.	c	.....	25,700	0.98
Victoria, B. C.	c	.....	24,436	0.88
Brantford, Ont.	c	.....	11,225	0.90

(Cont. in 3d col.)

Curb and Gutter (cont.)

WISCONSIN.			
Beloit	80,000	.....	0.34
Columbus	1,000	800	0.55
Eau Claire	800	.....	0.40
Green Bay	7,558	34,774	0.50
LaCrosse	.....	6,350	0.52
Lake Geneva	2,131	400	0.50
Madison	20,000	20,000	0.55
Marinette	.....	1,575	0.44
Milwaukee	60,000	87,140	0.47
Neenah	.....	4,800	0.45
Superior	21,000	13,400	0.60
West Allis	5,700	.....	....
WYOMING.			
Cheyenne	.....	5,683	0.78
CANADA.			
Vancouver, B. C.	.....	7,646	0.59
Chatham, Ont.	.....	848	0.45
London, Ont.	35,240	29,355	0.38
Regina, Sask.	o	25,350	0.72

a—Amount undetermined.

Sidewalks (cont. from 2d col.)

Chatham, Ont.	c	6,000	6,600	0.91
Kingston, Ont.	c	.....	13,115	1.35
London, Ont.	c	21,142	18,246	1.08
Oshawa, Ont.	c	2,780	7,200	0.90
Windsor, Ont.	c	.....	18,250	0.95
Regina, Sask.	c	6,000	37,885	1.50
Regina, Sask.	v	2,900	20,300	0.87

a—Amount indefinite.
b—Brick.
c—Concrete.
d—Cement tile.
e—Cinders.
g—Granite.
h—Sand and gravel.
k—Tar concrete.
p—Sidewalks laid by property owners privately.
r—Reinforced with triangular mesh.
s—Flagstone.
u—Crushed stone.
v—Plank.
x—Asphalt concrete.

Street and Sidewalk Improvement in the United States and Canada (Cont. from p. 343).

Toledo, O., will use a combination sand and asphaltic filler for joints in brick, granite and Medina stone.

Lansford, Pa., has substituted slag screenings for sand in cushion.

Lehighton, Pa., makes cushion 2 inches.

North Bradford, Pa., changed from repressed block with sand filler to wire-cut-lug block with cement filler.

Orangeburg, S. C., has made its specifications agree with those of the National Paving Brick Manufacturers' Association.

Concrete.—Fulton, Ill., will use curb monolithic with concrete pavement instead of combined curb and gutter, and a thinner expansion joint.

Alpena, Mich., will build some one-course pavements and some one-course roadway without curb.

Monroe, Mich., has decreased the width of transverse joints to ¾-inch.

Mankato, Minn., has increased the proportion of cement in the concrete.

Norfolk, Neb., has prepared specifications for its first concrete pavements.

Toledo, O., has added metal reinforcement and expansion joint protection for concrete.

Greenville, O., has specified prepared felt and asphalt expansion joints.

McAlester, Okla., will build concrete curb monolithic with concrete pavement.

Erie, Pa., has changed specifications for concrete base from 1:3:8 to 1:2½:7.

Lake Geneva, Wis., specifies concrete instead of wood block pavements.

Oshkosh, Wis., leaves it optional with property owners as to whether bituminous top shall be used on concrete pavements.

Stone Block.—Portland, Me., is relaying old granite blocks on concrete base.

Springfield, Mass., will use 4 to 5-inch granite blocks.

Albany, N. Y., specifies dressed granite blocks 4¾ to 5¼-inch depth.

Toledo, O., will use a combination sand and asphaltic filler for brick, granite and Medina stone.

Wood Block.—Decatur, Ill., has changed from 18 to 14 pounds of creosote per cubic foot of wood.

Granite City, Ill., will hereafter use a dry mortar cushion, 1 cement to 4 sand, instead of sand cushion, and reduces the concrete base from 6 to 5 inches in thickness.

Portland, Ind., has included wood block in the kinds of pavement specified.

Springfield, Mass., has adopted the standard specifications of the American Society of Municipal Improvements.

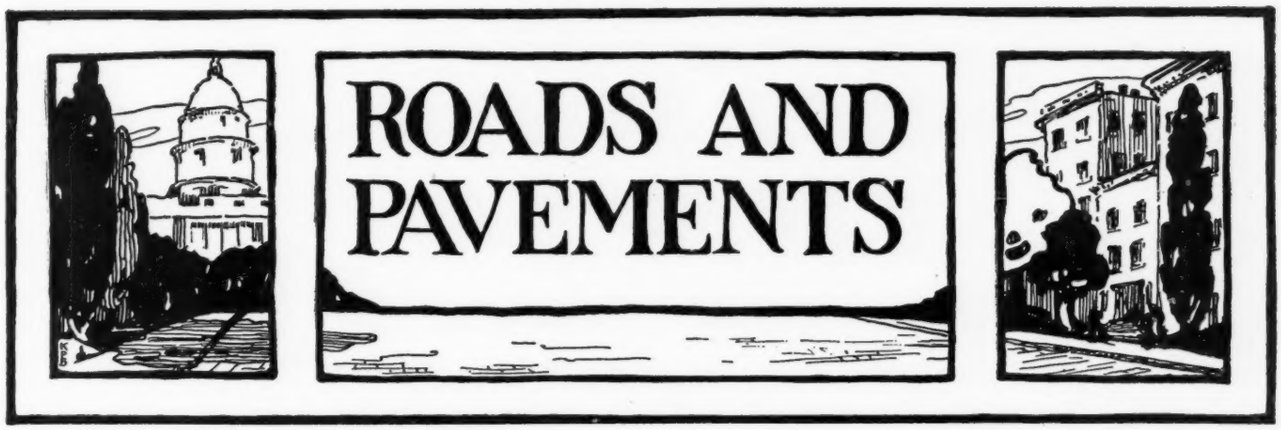
Highland Park, Mich., has added wood block specifications.

St. Paul, Minn., has made changes in specific gravity of creosote oil and in the standard of purity.

Albany, N. Y., has reduced amount of preservation oil from 20 pounds to 18 pounds per cubic foot.

Nashville, Tenn., has changed grade of creosote to meet war conditions.

Lake Geneva, Wis., specifies concrete instead of wood blocks.



Improvement of Sheridan Road in Highland Park, Ill.

By Stanley E. Bates, Chicago, Ill.

Sheridan road is the name given to the main highway which extends from Lincoln Park in Chicago to Milwaukee along the shore of Lake Michigan. The southern end of this road is within the city limits of Chicago and is under the jurisdiction of the Lincoln Park Commissioners.

Some time ago an act was passed by the Illinois legislature enabling the Lincoln Park Commissioners to assume control of the entire boulevard, subject to the consent of the municipalities thru which it passes. There are about a dozen of these different cities, villages and townships between Chicago and the Illinois-Wisconsin line, and the intention of the legislature was to unify the control of the road so that there would be a high-class pavement thruout its length, perpetually maintained in good condition. However, nothing has yet been done by the park commissioners because some of the municipalities have declined to surrender jurisdiction.

Highland Park is one of the cities which Sheridan road traverses and is located in Lake County about 25 miles north of Chicago. Many years ago, the road within the city limits, a distance of something more than three miles, was paved with macadam. Because the increase of automobile traffic necessitated frequent and expensive repairs, it was decided that a more durable pavement must be laid.

Early last year, therefore, the board of local improvements of Highland Park decided to pave the road for a distance of a little more than a mile with reinforced concrete.

The work of laying sewers, building of catch basins and grading the road was begun in the latter part of June, 1914, and was prosecuted vigorously to completion on about August 3. Due to delay in getting granite on the job, however, concreting did not start until September 15, and was completed November 10. The total amount of concrete laid was 17,260 yards, the width being 23 feet from back to back of curbs.

The sub-grade was prepared by grading, scarifying and resurfacing the old macadam road, care being taken to preserve the old road bed in as compact a condition as possible. After this was done it was thoroly sprinkled and rolled with a 10-ton road roller. Drainage was provided for by means of 6, 8, 9 and 12-inch tile laid in cinders along both sides of the street, three feet below the established grade.

Upon this prepared sub-grade the concrete was placed 8½ inches thick at the center and 5¾ inches at the sides. Two-course construction was employed, proportions for the base being 1 part cement, 2½ parts fine aggregate and 4 parts coarse aggregate and for the wearing surface, 1 part cement, 0.95 parts fine aggregate and 1.25 coarse aggregate.

Fine aggregate consisted of a very clean, hard silica containing not over 2 per cent. of silt. It was well graded from fine to coarse.

Coarse aggregate for the base consisted of clean washed gravel graded from ¼ to 1½ inches, and for the wearing surface Wisconsin granite varying in size from ¼ to ½ inch except some used on the last part of the work, when, in order to complete the pavement before freezing weather set in, a somewhat larger size was accepted. This material was perfectly clean, well graded and an excellent material for the purpose.

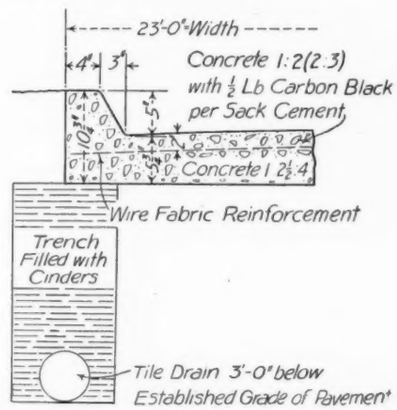
The equipment used by the contractor comprised a 10-ton gasoline road roller, a mixer of 12-foot capacity equipped with boom and dump bucket, and smaller equipment consisting of wheelbarrows, shovels, strike board, wood floats, etc.

Mixing and placing of concrete was done in the ordinary approved method, both courses being struck off by means of a wooden steel-shod templet and finished by wooden hand floats, a man working from a bridge spanning the entire pavement.

The reinforcing, consisting of No. 29 triangle mesh, was placed between the base and wearing courses of the concrete, with the heavy wires running at right angles to the center line of the street. The reinforcement was lapped two inches. Transverse joints were placed 33 1/3 feet apart and protected by steel plates ¼ inch apart. The space between was filled with prepared felt.

As soon as the concrete had set sufficiently it was covered with a layer of earth about two inches thick and kept wet by sprinkling two or three times a day, depending upon weather

SECTION OF CURB AND GUTTER *used on Sheridan Road, showing also the method of sub-drainage to keep water out of the sub-grade of the pavement.*



LAYING CONCRETE PAVEMENT *in Sheridan Road in Highland Park, Ill. Concrete mixing and laying in the background; finishing concrete surface in middleground; completed surface in foreground; curb forms shown in place.*

conditions. On work done after October 27, when cool weather set in, it was thought best not to cover the concrete, but during the hottest part of each day it was sprinkled lightly.

Probably the two most interesting features of this construction were the use of curbs built integral with the pavement and the darkening of the surface by means of carbon black added to the concrete.

For the curbs, whose dimensions and forms are shown in the accompanying diagram and illustration, the same mixture was used as in the top course of the pavement, but in general with a little more water added. Except on curves at street intersections the concrete was placed between the forms and left to harden sufficiently, after which the inside planks were removed and the concrete finished with a special trowel formed to the required section. The transverse joints in the pavement were carried thru the curbs but without the steel protection plates, the edges of the concrete next to the felt being rounded to a radius of ¼-inch to prevent possible spalling. Where the curbs were on a sharp curve the concrete was heaped up against the outside form and struck off to the proper shape with a small template. After hardening it was finished in a similar manner to the straight curb.

One-half pound of carbon black to each sack of cement added to the mixture for the top course was found to give a very pleasing slate color to the pavement. This was desirable in this case, as Sheridan road is more in the nature of a boulevard than a city street or country road, in either of which cases this darkening of the surface would have been unnecessary.

The total contract price for the 17,260 square yards was $35,222.30. Subtracting the amount paid for grading, sewerage, etc., the total price per square yard came to $1.07, exclusive of the cost of cement.

Contractors were Goelitz and Johnson of Oak Park, Ill. The engineer was Charles E. Russell, city engineer of Highland Park, who prepared the specifications and had general supervision of the work.

That this pavement is satisfactory in every respect and in fact, that it is a source of the greatest satisfaction and pride to the residents of Highland Park, was evidenced at the dedication, which took place on November 28, 1914. This dedication was organized by the Highland Park Business Men's Association, and consisted of a procession of automobiles, led by the city's new motor fire truck, and speeches by Mayor F. P. Hawkins, of Highland Park, and W. G. Edens, president of the Illinois Highway Improvement Association and of the Associated Roads Organizations of Chicago and Cook County, the official letting down of the bars, the christening of the highway and a luncheon.

Colloids in Relation to Manipulation of Structural Materials

For a year or more Clifford Richardson, long known as one of the foremost asphalt chemists, has been investigating the colloidal state of matter as found in particular in asphaltic substances. From a highly technical article in the Harvard Technology Monthly, the following has been abstracted to indicate the nature of his investigations and conclusions regarding the colloidal state in asphaltic paving mixtures and the corresponding conditions developing in the use of other building materials.

The colloidal state is not limited to any particular class of matter, since, according to recent theories, all substances can be brought into this state by appropriate means. The quality of the colloidal state of most interest for the purposes of Mr. Richardson's paper is the very high degree of dispersion in which the matter exists. A disperse colloid must exist in a system of two phases; the internal or disperse phase, which may be solid or liquid, and the exterior or continuous phase in which it is dispersed. A solid in the disperse phase in the colloid form ordinarily is in a state of subdivision or degree of dispersion, in which the particles are smaller than 0.0001 mm. in diameter, and in some solids no larger than 0.000,006 mm.

The peculiar characteristic of disperse colloids lies in the enormous surface area which they present in comparison with the amount of solid material which they represent, the great surface energy developed thereby, and their capacity for selective adsorption. A realization of this may be arrived at from the fact that if the amount of material represented by a cube, one side of which has a dimension of one cm.,

is reduced by decimal subdivision only to the coarsest colloidal size, a ten-thousandth of a millimeter in diameter, the number of cubes produced would be 10 to the 15th power, while the surface would be increased to 60 square meters, or 100,000 times more than that of the original cube. The enormous surface area displayed by colloidal material is, in this way, made evident. The chemistry of colloids is, therefore, one of surface, of films and has a large bearing on bituminous highway construction.

A substance existing in a colloid state or solution differs from an ordinary solution in that, although highly dispersed, it is not in a state of molecular diffusion. For this reason colloidal solutions do not readily diffuse thru semipermeable membranes in the manner observed with molecular solutions. This can be illustrated by the formation of colloidal silica by adding an acid to a solution of silicate of soda. A jelly-like mass of colloidal silica and common salt are formed with water. The salt can be removed from the jelly by diffusion thru a semipermeable membrane, into water, owing to the fact that it is in molecular solution. The colloidal silica remains within the membrane containing it. By appropriate means salt can be obtained in a colloid condition, indicating that crystalline as well as other forms of matter can be transformed into the colloidal state.

As colloids are not readily diffusible thru semipermeable membranes, as is the case with crystalline substances in molecular solution, a study of substances in this state may be carried on with interest, as for example, that of the native bitumens, including petroleum. It appears that some of them form colloidal solutions, as determined by the fact that with appropriate solvents, carbon disulphide or benzol, they will not diffuse thru a semipermeable membrane into the same solvent, while others, on the contrary, of a crystalline character, as for example, paraffine scale, will diffuse from their solution readily. This enables us to differentiate the native bitumens or petroleums into two classes, those consisting of bitumens forming colloidal solutions and those which readily diffuse when in molecular solution.

Different oils can be characterized and differentiated by the relative amount of colloidal and diffusible matter which they contain, on subjecting them to diffusion. That this goes on readily has been determined by adding a certain amount of crystalline paraffine scale or sulphur to an asphaltic colloidal bitumen and subjecting the mixture to diffusion. The crystalline scale or the crystalline sulphur can be separated from the colloidal bitumen in this way and recovered. This will afford a means of studying the character of our native bitumens and petroleums with interesting results. As an example of some preliminary data obtained in this way, the following figures will serve:

DIFFUSIBILITY OF ASPHALTS AND PETROLEUM PRODUCTS THRU SEMIPERMEABLE MEMBRANES.

Sample	Weight of Residue By Diffusion from 1 Gram		Description
	Gr.	%	
1. Bermudez Asphalt 5% paraffine scale	.0433	4.33	Paraffine
2. Bermudez Asphalt 5% sulphur	.0478	4.78	Sulphur
3. Blown oil residue	.039	3.9	Oil & Sulphur
4. Texas residual	.020	2.0	Colorless wax
5. California residual	.017	1.7	Brown wax
6. Mexican residual	.005	.5	Colorless oil
7. Paraffine residual	.0025	.25	Colorless oil
8. Trinidad residual	.000	.0	
9. Bermudez asphalt	.000	.0	
10. Bitumen from Trinidad asphalt	.000	.0	

It appears that there are evident differences in the character of the various bituminous materials occurring in nature which have been examined by diffusion, and it is a striking fact that the native asphalts from Trinidad and Bermudez are the only forms of bitumen which yield nothing in this manner. This method of study will, when completely worked out, be an interesting means of differentiating the various bitumens which are in use in the construction of pavements and highways.

A still more interesting fact from the point of view of colloidal chemistry is that one of the native asphalts, that from the Island of Trinidad, contains a considerable amount of clay in the disperse solid colloid form, in fact, as a bitusol, that is to say, a colloidal solution of clay in bitumen. Its colloidal nature is demonstrated by the fact that when Trinidad asphalt is dissolved in a solvent such as carbon disulphide or benzol and the solution is allowed to stand for some months, or when sedimentation is accomplished by centrifugal force, it will still be found to contain from 8 per cent. to 4 per cent. of mineral matter in colloidal solution, as recovered by ignition, which cannot be separated from the bitumen except thru what is known as an ultra-filter. This clay is so impalpably fine that it is, therefore, in a colloidal state and remains suspended in the solution indefinitely. It is invisible under the ordinary microscope, but under the ultramicroscope, which makes it possible to detect particles of colloid size, these are seen in the microscopic field in the highly characteristic state of motion which distinguishes disperse solid colloids and is characteristic of the form of matter.

The importance of the presence of colloid clay in Trinidad asphalt is due to its great power of selective adsorption and to the great surface energy developed by the enormous surface area of the disperse solid colloidal particles. The importance of this in the construction of bituminous highways, especially sheet asphalt pavements, and the great stability which it contributes to the cementing or binding material and to the mass as a whole must be evident, and it is sufficient explanation of the greater satisfaction obtained with surfaces made with bitumen containing colloidal clay.

The formation of colloids by the action of water on the fine material, or even to some extent on the coarser particles of a water-bound macadam road, accounts for the hard crust which results in this form of construction of road surfaces. Colloids, which are always present in different degrees in clays, are also responsible for the cementing of the particles forming the well-known sand-clay surface.

In at least one other direction colloid chemistry is of great interest to the engineer; in connection with the setting of Portland cement. If Portland cement is ground in a tube mill for a long time with water, it is found that it is largely converted by the hydration of its components into a material of colloidal gel-form, and in this form it is used for special purposes which it fills with great satisfaction. If Portland cement is made into a mortar with water, the formation of colloid goes on during the setting of the cement while at the same time a certain crystallization of other products of the hydration of the cement takes place in the gel. The colloid imparts hardness to the cement, being converted into a glassy mass, such as that obtained by drying out the gel of silica produced by the action of acid on water-glass. The setting of the cement is, therefore, explained in part by the formation of colloids.

Colloids play important roles in many industrial processes, notably in the preparation of tungsten filaments for electric lamps, in the ceramic industry, adhesive and glues, dyeing, bleaching, and clearing of liquids by the adsorption of colloids, tanning, the manufacture of soap, brewing, greases for

lubricating, and emulsions of various kinds. In fact, it is becoming recognized that colloidal chemistry, regarded from the point of view which now governs our conception of it, is of more general application than has been heretofore imagined.

Shockless Railroad Crossing

By E. S. Cobb, Los Angeles, Cal.

For many years there has been a strong demand for a shockless railway crossing from the general public in cities, that the noise incident to crossings shall cease, whatever the expense or the benefits to a railroad corporation may be; and from railway officials themselves, who are vitally interested in reducing the tremendous cost of upkeep of railway crossings, special work, and the adjacent road bed and the high depreciation of wheels, axles, brakes, wiring and the general fittings of rolling stock, due to the present forms of crossing construction.

A design intended to meet these demands consists in arranging the four or more rails forming the closing members of the intersection, so as to give them vertical motion between solid fixed guides. The ends of these movable rails are framed at an angle with one another, thus forming an interlocking joint, and they are given a vertical motion by the action of two wedges under each rail. These wedges move longitudinally as compared to the rail, and when in position to hold the rail in its uppermost position, they extend to the outer extremities of the rail and support the same in an absolutely safe and rigid manner, the same as the piers of a bridge support the bridge. These wedges are also designed in such a way that when they are withdrawn, they draw the rails downward. This construction, taken in connection with the solid guides provided to direct the vertical motion of the rail, results in the rail being under absolute control in all its positions and locked solid when in position for use. The wedges under the several rails are so connected that when one pair of rails is raised to an operating position, the other pair is drawn downward to its lowermost position.

There are no moving parts in the whole construction which are subjected to any load or strain whatever due to traffic, except the wedges mentioned, and they are of such form and proportions as to give long and safe service. When the weight of any rolling load comes upon these rails and wedges, all parts are locked in a fixed position. The rails, themselves, have only vertical motion. The covers shown in the illustrations closing over the mechanism between the several movable rails can be made in trough form, where the crossing is used in the city streets, in such manner as to be filled with the same paving material that is used in the remainder of the street surface. Under such conditions, then, the intersection would present no more metallic surface to observation in a public street than is at present in view with the ordinary intersections, and there are no moving parts above or along the surface of the ground.

The mechanism below the surface of the ground, and contained in the main foundation frame of the crossing, is of the simplest character, comprising simply gears, links and wedges, all having slow motion, ample wearing surface, great strength of form, and only operating to raise and lower the individual pieces of rail. And all is so arranged that the rails when in position for use, are locked against motion in any direction, and they cannot be displaced from their positions by any effort less than that which would destroy the rail itself.

In the photographs, the smaller box shown between the rails, is water tight and contains in the particular case illustrated, the motor for operating the crossing. But these crossings can be equally well operated by hand, chain or rod, or switch throw, or by compressed air mechanism, or by any method deemed advisable or necessary at any particular location, the only requirement being that the main driving shaft running under the crossing shall make one-half revolution in one direction to bring one pair of rails into effective position, and then one-half revolution in the opposite direction, to bring the other pair of rails into effective position.

Two of these crossings have been installed at the intersection of two high-speed tracks of a four-track electric system with a single-track steam road, where the traffic is in both directions. One of these crossings has been in continuous service over eight months and the other, constructed in exactly the same manner, for about four months less time.

At the particular intersection where they are located an interlocking tower is in use controlling the switches, derailers and semaphores, and these two crossings are likewise controlled from the same interlocking tower, and in the particular case illustrated, they are each driven by an electric motor in the same manner as the electric motors are used for opening and closing the split switches and for operating the semaphores.

Both of these crossings have been subjected on the electric road, to a daily traffic of over 15,000 tons, consisting of 360 high-speed heavy electric cars, made up in 240 trains; also to 5,000 tons traffic per day on the steam road, made up of heavily-loaded freight cars for the most part, and a few passenger trains.

The time required to make the change from operating position in one track to operating position in the other track, is about 3½ seconds.

The rails used in the construction of this intersection may be of any cross-section, the same as used in the adjacent tracks. The rails do not wear any faster than the rails along the main line of the track. The intersection provides a smooth rolling surface from the main road on one side to the main road on the other side, and the consequence is that the rails are only subjected to rolling wear without shock. Experience has shown that the rails of the intersection will last just as long as the rails of the remainder of the line wherein the intersection is placed.

In the design of this intersection, there are no places where any foreign material can become compressed between any two surfaces, and when the intersections are constructed

A SHOCKLESS RAILROAD CROSSING *set for the electric car to pass on continuous surface of rail parallel to the lines of words. The rails in the steam railroad track are lowered out of the way. The positions of rails will be reversed when the steam railroad train is to pass. The mechanism for making the movements is under the lettered plate and in the box, the cover of which is seen at the right of the railroad track and between the rails of the electric line.*

A NINETY-TON LOCOMOTIVE *passing over the shockless crossing. Note the continuous line over which the wheel is passing, causing no drop of the wheel as it crosses the cut in the interesecting rail and consequently no shock. This continuity is shown even more clearly in the contacts of the rails on the left, especially the farther rail where it intersects the left rail of the electric railway track.*

along the general designs shown, there is no way for any foreign substances to get at or into any of the working parts. There are no moving pieces of mechanism, not a rod, nor a rocker arm, nor anything that requires care or attention, above or along the surface of the ground. During the time this intersection has been in operation, it has never caused a moment's delay in train service and it has not cost a cent for repairs or maintenance; it has received the same general supervision and lubrication that has been given to the mechanism for operating the split switches and the semaphores, and no more. And this experience has not developed the necessity of changing a feature or an element of the design.

Experience has shown that the cost of installing these intersections is no greater than the cost of installing an ordinary intersection. But the main foundation portions of the shockless crossing need never be disturbed, and the rails or any other wearing parts can be replaced in a few hours' time without disturbing any of the tamping or adjacent paving materials. The cost of manufacturing these intersections is only slightly greater than that of ordinary intersections, and the additional expense for most installations would be that represented by the cost of operating the crossing. If operated by electric motors, then the cost of the motor; if operated by hand, then the cost of the hand operating mechanism, etc.

Profits of San Francisco Municipal Railway

The excess of receipts over expenditures by the San Francisco municipal railways has increased from month to month, and since the opening of the exposition at a rapid rate. During the four months, including June, 1914, of operation, the receipts exceeded the expenditures by $84,864.26, an average of $21,000 a month. In August, 1914, the excess of receipts was $45,851.74, in October, $49,859.64.

The net operating revenue for 1914 was $336,905.58, an average of over $33,000 a month for the ten months of operation, including the low months of the start. The net profit for the year, after deducting allowances for depreciation and interest, was $216,541.25.

For the last two months reported the excesses of receipts over expenditures are $64,515.26 for February and $74,102.03 for March, so that the profits for 1915 promise to be materially greater than in 1914. This increase in gross profit is obtained notwithstanding an increase in expenditures from $54,887.20 in August, 1914, to $123,463.97 in March, 1915.

Tires for Fire Apparatus

Fire apparatus thruout the country is rapidly being motorized, the expense of maintenance under the conditions in most cities being much less with motor apparatus. Specially designed tires are necessary for the heavy machines traveling at high speed. Cushion tires are much safer than pneumatic tires. But the cushion tire must be of special design to provide the necessary resilience under the heavy loads and to absorb the excessive vibrations under high speed. Ordinary commercial motor vehicle tires, designed for lighter weights and speeds of 10 to 15 miles an hour are not suited for 25 to 30 miles an hour the impact at the higher speeds being at 30 miles an hour nine times what it is at 10 miles.

Markers for National Highways and Their Feeders

Each of the most highly developed trans-continental highways has adopted a distinctive type of sign to mark its course. These signs are painted on telegraph and telephone poles, on suitable fences and buildings and are also made on metal or wood backgrounds to be set in place on posts or attached to existing objects.

The National Old Trials Highway Association has adopted a special design with which the line has been marked from the Pacific coast to St. Louis, and at intervals along the old National Road.

The secretary of the Dixie Highway Association is just now looking for a suitable concrete post to which to attach its markers and wants to buy the forms for making them to distribute among the road authorities along the line so that they can make the posts and set them.

The Lincoln Highway is well marked in many sections and has signs at all points of turning from end to end so that it can be followed without difficulty. The American Institute of Architects and a National Commission of Architects have been given the task of designing an appropriate marker.

Meantime a temporary marker has been copyrighted for use only on the Lincoln Highway which is ordinarily painted on poles. It is rectangular, 21 inches high and of convenient width for the location. The top 3 inches is a red strip. The next 15 inches is white and the bottom 3 inches is blue. A letter L about 7½ inches high is painted in blue on the white and a small c, to indicate the copyright. The word Lincoln may also be painted in blue on the white above the large L and the word Highway below it.

A second sign for use on branch lines leading to the Lincoln Highway is 23 inches high with 4-inch red strips at top and bottom. In the 15-inch white space in the center are arrows and names of localities at top and bottom and an arrow in the center pointing toward the Lincoln Highway with ——MI TO above the arrow and LINCOLN WAY below. The small c must also appear to indicate the copyright.

The Hagar Portland Cement Co.

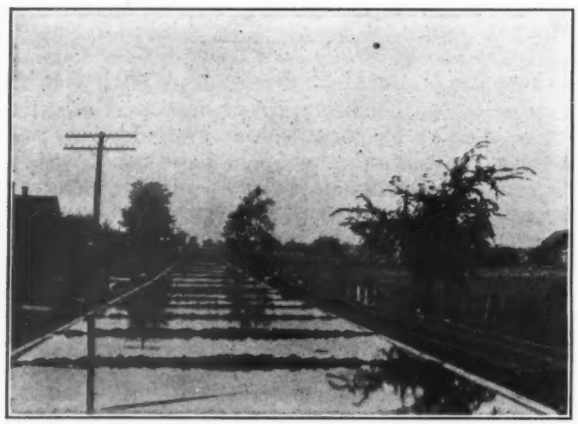
A charter has been issued under the laws of Maine incorporating the cement company projected by Edward M. Hagar, who lately resigned the presidency of the Universal Portland Cement Company for the purpose of organizing a company to acquire and operate a chain of cement plants to cover the ter-

ritory between the Atlantic seaboard and the Rocky Mountains. It is called Hagar Portland Cement Co., and has a capital stock of $20,000,000, all common.

The officers include Edward M. Hagar, president; Morris Metcalf, vice president; B. H. Rader, vice president and sales manager; Gordon Wilson, secretary and in charge of cost accounting; Leonard Wesson, assistant to president in operation and construction; J. P. Beck, assistant to president in extension work; C. W. Lyon, engineer of economies; J. H. Barbazette, superintendent of construction. Pending the election of a permanent treasurer, the office will be filled by Gordon Wilson. The general offices of the company are located at 208 South LaSalle street, Chicago.

Ponding for Curing Concrete

The photograph herewith shows a peculiar method of treating a concrete road, the sides being put in such condition that it was possible to cover the concrete with water in sections during the process of curing. This certainly supplies the desired water, but whether the result is better than with the usual covering with sand and earth kept moist is not stated. The method is not one generally applicable, grades being usually too great.



Philadelphia Posts Information About a Newly Paved Street

Philadelphia, Pa., is just completing the paving of Germantown avenue with improved granite block with grouted joint and laid on a 6-inch concrete foundation.

Chief Engineer William H. Connell has had some very attractive frames made with glass front covering a large poster card, explaining the construction of this street and calling the attention of the public to this pavement as a desirable pavement for a business street. These are put in prominent positions on Germantown avenue at various points, Market street and several other streets on which the improved granite block with grouted joint pavement has been laid.

The information on the card reads as follows:

Improved Type of
GRANITE BLOCK PAVEMENT.
On Six-Inch Concrete Base.
Germantown Avenue.

The construction of this pavement presents:

The latest and best practice in granite block paving work.

A type designed to withstand the extremely heavy traffic on this street.

A surface which will be smooth riding for automobiles and afford a good foothold for horses drawing heavy loads.

Foundation Course:

The pavement is laid on a six (6) inch concrete base mixed in the proportions of one part portland cement, three parts sand and six parts stone.

Cushion Course:

Between the concrete foundation and the block surface there is a one-inch sand cushion.

Surface Course:

The improved granite blocks are from eight to twelve inches long, three and one-half to four and one-half inches wide, and from five to five and one-half inches deep, accurately dressed. The heads are so cut that they have no more than three-eighths of an inch depression from a straight edge laid in any direction across the head and held parallel to the general surface of the block. The joints are not more than one-half inch wide at the top and for a depth of one inch, and not more than one inch wide in any other part of the joint. They are filled with a grout of portland cement and sand in the proportion of one part of cement to one part of sand.

For further information, apply to
Chief Bureau of Highways and Street Cleaning,
Room 232, City Hall Philadelphia.

This is a novel way for city engineers to inform the public as to the nature of a pavement, tho it has been used to mark the limits of various kinds of construction used in experimental highways, the most detailed information being furnished in like posters along the experimental road surface laid on the highway thru Chevy Chase, Md., by the U. S. Office of Public Roads.

Large Municipal Swimming Pool in St. Louis

The accompanying photograph shows the fair ground pool St. Louis, which is just opening its third season as a swimming pool. It holds almost 4,000,000 gallons of water and accommodates 2,500 bathers at a time. It is said to be the largest artificial out-of-door swimming pool in the world.

The National Parks Highway

For the last three years all the towns and cities on the Yellowstone Trail have been making an effort to build a good automobile road from St. Paul and Minneapolis to Yellowstone Park by way of Lake Calhoun, Olivia and Ortonville, Minn., Aberdeen and Mobridge, S. D., Hettinger and Marmarth, N. D., and Terry, Miles City, Billings and Livingston, Mont. At the same time, western Montana has been building the Park-to-Park Highway, from Gardiner, Mont., to Belton, Mont., by way of Livingston, Butte, Missoula and Kalispell, Mont.; and the state of Washington, the Sunset Highway, from Spokane to Seattle.

In January, 1915, representatives of all these highways met at Seattle. It was then decided to amalgamate the three roads, so as to make a good connected road from Chicago to Puget Sound. It was recommended that the name of the amalgamated road be "National Parks Highway."

In the last two years, a million dollars was spent in the construction of the eleven hundred and fifty miles between St. Paul and Yellowstone Park. In Minnesota, the work was done under the supervision of the state highway engineer, and is maintained by the state.

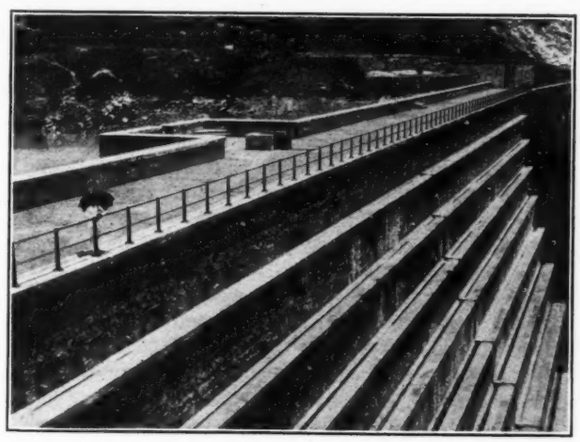
Entering South Dakota at Big Stone City, the Trail is graveled from there westward, to a considerable distance beyond Milbank, and is in splendid condition. Much of the remainder of the line in the state is graded but some is still the natural prairie road.

The North Dakota section has some graded road, but most of it is the prairie soil. The same is true of many sections in Montana and much work must be done to make these sections and those farther west comfortable for thru travel.

The Water Supply of Hong Kong, China

Hong Kong, China, is located on a mountainous island and obtains its water supply from the Pokfolum reservoir, located in a natural basin, with long slopes of the surrounding hills forming its watershed. One of the photographs gives a general view of this reservoir, which has a capacity of 68,000,000 gallons.

The water is impounded by two concrete dams across two water courses, which may be seen on the farther side of the reservoir in the photograph. One of these dams is shown in closer view in the second photograph.



Lincoln Highway Promotion

The national headquarters of the Lincoln Highway have issued a guide book and map of the highway which indicates that during the part of 1913 and the year 1914, which covers the time from the beginning of real work on the line, the communities thru which it passes spent nearly $3,000,000 on its improvement. In three states there are at present $1,980,000 of contracts let and not yet completed and advertised for immediate letting.

An effort is being made to promote the construction of the Lincoln Highway by means of moving pictures. The local communities were first interested to improve their sections of the highway and the films show them at work or show the completed road. Covering the whole 3,384 miles of the road requires some 7,000 feet of film. Local communities on payment of fixed sums can have the use of the films they wish to show their people, and they are shown in cities and towns elsewhere in the promotion of the use of the highway as a transcontinental line.

Brick is now in use and brick surfaces are now under construction, so that it will not be a continuous concrete highway as was at first intended. Until hard surfaces can be paid for and laid by the local communities or the states take up its construction, or the United States decides that it has a duty to perform upon the transcontinental lines, there will be many miles of macadam, gravel, oiled macadam, gravel or dirt, and plain dirt road to traverse along the Lincoln Highway.

There is considerable rivalry between the Lincoln Highway and the National Old Trails Road and in the eastern states the latter has at present some advantage as the present year will see most of the gaps closed in the brick, concrete, and first-class macadam road from the eastern end to the Indiana line.

Changes in Specifications for Curb, Gutter and Sidewalks

The following changes have been made in specifications for 1915 for curb and gutter and sidewalks:

Combined Curb and Gutter.—Caldwell, Ida., will use one-course concrete instead of two-course.

Fulton, Ill., will use curb monolithic with concrete pavement instead of combined curb and gutter, and a thinner expansion joint.

Des Moines, Ia., has discontinued construction of concrete combined curb and gutter.

Wapakoneta, O., has changed dimensions of concrete combined curb and gutter.

Curb.—Caldwell, Ida., will use one-course concrete instead of two-course for all curb, gutter and sidewalks.

Fulton, Ill., will use curb monolithic with concrete pavement instead of combined curb and gutter, and a thinner expansion joint.

Kansas City, Mo., now makes curb of concrete without mortar face.

Syracuse, N. Y., limits the kinds of curb to Medina and Hudson River stone and portland cement with steel edge protection.

Mansfield, O., will set curb in stone instead of concrete.

Mt. Vernon, O., will use larger radius on round-corner curbs.

McAlester, Okla., will build concrete curb monolithic with concrete pavement.

Sidewalks.—Caldwell, Ida., will use one-course concrete instead of two-course for all sidewalks, curbs and gutters.

Richfield, Utah, changes thickness of top from ½ to ¾ inches.

MISCELLANEOUS

The International Engineering Congress

The general program of the International Engineering Congress and engineering society conventions to be held at San Francisco, September 16-25, in connection with the Panama-Pacific Exposition, has been issued and copies can be obtained on request of W. A. Cattell, secretary, 417 Foxcroft Building, San Francisco, Cal.

The conventions of four of the societies under whose auspices the Congress meets, will be held September 16 and 17 as follows: That of the American Society of Civil Engineers at St. Francis Hotel; American Society of Mechanical Engineers at N. S. G. W. Hall; American Institute of Mining Engineers at Hotel Bellvue; American Institute of Electrical Engineers in the Civic Center Auditorium.

September 18 and 19 will be devoted to execursions to points of engineering interest, from which members of the Congress and of the engineering societies must choose, as their periods overlap. They include the San Francisco high-pressure fire system, gas works, electric station, Spring Valley water works properties east of the Bay and those on the peninsula, the Delta of the Sacramento and San Joaquine rivers, the Feather river hydroelectric development, gold dredging at Oroville, hydroelectric development at Lake Spaulding, gold mines at Grass Valley and the oil fields at Coalinga.

A special trian will be made up at New York to arrive in time for the meetings, and those who wish to travel on that train should notify the secretary where they will join it.

The Pan-American Road Congress will be held the week of September 13 at Oakland, and its executive committee will also run a special train from the east which will be a few days earlier than the special of the engineering societies.

Portland Cement Production and Cost

For almost the first time since the phenomenal development of the American portland cement industry began there has been a reduction in consumption for the year. Production in 1914 was 4.2 per cent. less than in 1913, and shipments were 2.54 per cent. less. The total production in 1914 was 88,230,170 barrels, and the average price per barrel at the mill was 92.7 cents. The price was reduced from that in 1913 by 7.76 per cent.

Albert Moyer has made a table with assumptions of costs of manufacture of cement in plants of 1,125,000 barrels capacity and 2, 4 and 8 times this capacity, and capitalizations of $1,250,000 and 2, 4 and 8 times the capitalization, respectively, and overhead charges for each size of plant, including also 7½ per cent. depreciation, obsolescence, etc., and of cost of manufacture in each size of plant. He then assumes rates of operation at 100, 75 and 62½ per cent. of full capacity and the higher costs per barrel at the lower rates of operation. By making the computations from these assumed data he shows that with cement selling at 65 cents at the mill plants of every size will show loss and that the smallest plants will show loss if the price gets as low as 70 cents. Only the largest plants operating at full capacity can make a profit of 7.2 per cent. on their capital stock with selling price at 75 cents, and the smallest plants can make only half this profit at that price. The smallest plant is bound to lose money at 75 cents sale price if it operates at a rate materially below full capacity. The economy of large plants even at the same rate of capitalization per barrel of capacity is clearly shown and the necessity of operating even the largest plants at 75 per cent. of capacity or more at the 75 cent selling price is fully demonstrated.

Commercial Education for Foreign Trade

The questions as to how far the present American system of commercial education meets the need of our developing export and import trade and what changes should be made to render the system more helpful, are the basis of an inquiry just begun by the National Foreign Trade Council through its committee on Commercial Education for Foreign Trade, of which the chairman is Wallace D. Simmons, president of the Simmons Hardware Company, of St. Louis. Business men engaged in foreign trade are requested to respond to the following five questions:

1. Do you find difficulty in obtaining young men whose education gives them the fundamentals which make it practicable for you to rapidly promote them in your export business, and to send them abroad as your representatives? If so, explain the difficulty and to what you attribute it. Suggest remedies (the more the better).

2. How effective and useful, in connection with foreign trade, is the customary two years' instruction in modern languages given in high schools? Suggest changes in these courses.

3. Do you find high school graduates efficient material for clerical work in the home office? If not, what appears to be their deficiencies? Suggest needed subjects for training. Suggest better methods of training.

4. What changes in their general educational training would you suggest for those who expect to become stenographers and corespondents in your export department? (This refers to work in the home office exclusive of that which requires a knowledge of foreign languages.)

5. To what extent have you employed graduates of colleges, or graduate schools, in the work of your home office, and to what extent has their preparation qualified them for work of

this character? In what, if any, respect has their education appeared not to meet the requirements? Suggest subjects in which additional training would be helpful.

The data obtained will be communicated to a large number of educators, and made the basis for a concentration of educational opinion, leading, it is hoped, to such changes in curricula as are shown to be necessary. The inquiry will also bring to the attention of business men what already has been done by educators.

Of Interest to Employers

Few of our readers are, perhaps, aware that the United States government, thru the Department of Labor, has inaugurated, as a part of the division of information, a country-wide employment bureau. It is the belief of those connected with the work that it will go far toward improving business conditions in the United States. The underlying principle of the work is, perhaps, best expressed by the Secretary of the Department of Labor in the following words: "The Department of Labor . . . has . . . established distribution branches thruout the country for the purpose, on the one hand, of developing the welfare of the wage earners of the United States, and improving their opportunities for profitable employment, and, on the other hand, of affording the employers a method whereby they may make application for such help as they need, either male or female, citizen or alien residents, and have their wants supplied thru said distribution branches. Comparative statistics show that there has been in some portions of the United States a surplus of labor, while in other portions a deficiency. It is believed that this condition will be almost, if not entirely, eliminated by this work. This will appear from the following brief explanation of the system under which the work is conducted:

First, the United States has been divided into eighteen sections, or "Distribution Zones" as they are called, and in each of these zones an employment office has been opened. These zones in nearly every case have been subdivided and branch offices opened under the jurisdiction of the controlling zone office. This means that a larger number of employment offices have been opened by the United States government. At these offices the employer who needs help of any kind, skilled or unskilled, can secure what he wants without any trouble or expense other than the work of stating his desires and the expense of a postage stamp if he finds it inconvenient to call at the distribution office in person. Neither is any fee accepted by the government from those seeking employment. It goes even further, every postmaster in the United States is a representative of the Employment Bureau. At every postoffice in the United States will be found, on application to the postmaster, blanks for the use of employers in need of help, and of unemployed persons seeking employment. These blanks, upon being handed to the postmaster are transmitted by him, free of charge, to the proper zone office, where both blanks are properly registered and proper help selected for the employer in need of help, either from applicants residing in the city in which the office is located or from the applications on file. On the day the employer's application is received by the distribution office a copy is sent to the Division of Information at Washington, D. C. At frequent intervals these applications are assembled and published in the form of bulletins and distributed to all distribution offices, thereby making it possible for each office to know where help of any description is in demand.

At the distribution office the best interests of the employer are kept constantly in mind, and only such help is selected for positions as are, in the opinion of the officer in charge, well qualified to perform the duties required.

If any reader of this journal is now, or expects shortly to be in need of help of any description, it is suggested that the following coupon be filled out and mailed to the address given:

Date.....

U. S. Distribution Branch, 845 Wabash Ave., Chicago, Ill.

On or about..... 1915, I expect to be in need of the following help: .....

Please send me the necessary information blank to fill out. It is understood that no fee will be charged for obtaining this help for me.

(Sign here).....

(Address).....

.....

Public Service Commission for Oswego

The legislature of New York has passed a law creating a public service commission for Oswego, for developing a municipal hydro-electric plant. J. F. Flanigan is city engineer.

The Engineering Foundation

Ambrose Swasey, of Cleveland, O., made a gift of $250,000 for fostering engineering research, for the administration of which a board was appointed and styled "The Engineering Foundation," by the United Engineering Society, representing jointly the national organizations of electrical, mining and mechanical engineers, with the co-operation of the American Society of Civil Engineers.

The first regular meeting of The Engineering Foundation was held May 25, and officers were elected, including Gano Dunn as president and F. R. Hutton as secretary. Rules of administration were adopted and many applications for the use of funds were received. A committee was appointed to consider them and to prepare a schedule of requirements to be met by applications before they can be considered. Dr. A. R. Ledoux is chairman of this committee.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

July 7-8: Illuminating engineer in office of Supervising Architect, Treasury Department, at $1,200 a year.

June 23-24: Electrical engineer and draftsman, in office of Supervising Architect, Treasury Department, at $1,200 a year.

June 23-24: Marine engine draftsman for submarines, in office of Inspector of Machinery, Electric Boat Co., Groton, Conn., and elsewhere, at $5.04 a day.

Technical Schools

The effect of boron upon the magnetic and other properties of electrolytic iron melted in vacuo, by Trygve D. Yensen, has been issued as Bulletin No. 77 of the Engineering Experiment Station of the University of Illinois.

"A Study of Boiler Losses" by A. P. Kratz, in Bulletin No. 78 of the Engineering Experiment Station of the University of Illinois, presents a critical analysis of the data taken from a series of twenty-five trials made on a 500-h.p. Babcock and Wilcox boiler in the university heating plant. The heat balance has been subdivided so as to isolate and determine the amounts of the several losses chargeable to the boiler, furnace and setting. Complete forms for calculating a series of boiler trials are also given. Tests were made also upon some samples of weathered coal. No difficulty was experienced in burning this coal, but it was found that it had deteriorated during the weathering until it was about the same composition and grade as fresh Vermillion county screenings.

The first annual letter of the Department of Civil Engineering of the University of Michigan shows an increase in enrollment in the past three years of more than 50 per cent. as a result of broadening the work of the department by increasing the number of groups of studies. Large increase in the amount of work done by the department is shown as the result of the two sources of increase, number of men and number of credit hours of work offered.

The fiftieth anniversary celebration of Worcester Polytenchic Institute, Worcester, Mass., was held June 6-10 in connection with the annual commencement.

Columbia University has appointed the following non-resident lecturers for the 1915-16 session of the graduate course in highway engineering: Charles J. Bennett, state Highway commissioner of Connecticut; John A. Bensel, consulting engineer; Will P. Blair, secretary National Paving Brick Manufacturers' Association; Sumner R. Church, manager research department Barrett Manufacturing Company; Frederick A. Cleveland, director Bureau of Municipal Research, New York; William H. Connell, chief Bureau of Highways and Street Cleaning, Philadelphia; Morris Llewellyn Cooke, director Department of Public Works, Philadelphia; W. W. Crosby, chief engineer Maryland Geological and Economic Survey and consulting engineer; Charles Henry Davis, president National Highways Association; A. W. Dow, chemical and consulting paving engineer; Edwin Duffey, Commissioner of Highways, New York state; Lewis R. Ferguson, assistant secretary Association of American Portland Cement Manufacturers; C. N. Forrest, chief chemist the Barber Asphalt Paving Company; Wilson P. Foss, Sr., president the New York Trap Rock Company; Walter H. Fulweiler, chief chemist the United Gas Improvement Company; E. P. Goodrich, consulting engineer; D. L. Hough, president the Cuban Engineering and Contracting Company; William A. Howell, engineer of streets and Highways, Newark; Nelson P. Lewis, chief engineer Board of Estimate and Apportionment, New York; Walter R. Marden, vice president and chief engineer the United Construction Company; H. B. Pullar, general manager the Pioneer Asphalt Company; Philip P. Sharples, manager general Tarvia department Barrett Manufacturing Company; Francis P. Smith, chemical and consulting engineer; Albert Sommer, consulting chemical engineer; George W. Tillson, consulting engineer to the president of the Borough of Brooklyn, New York; John Cassan Wait, attorney at law; George C. Warren, president Warren Brothers Company.

Technical Associations

The eleventh annual convention of the Associated Advertising Clubs of the World will be held in Chicago June 20-24.

At the June meeting of the Municipal Engineers of the City of New York, W. J. Hammer, lecturer for the Wright Brothers, gave an address on aeroplanes and airships, illustrated by models, photographs and lantern slides.

The Committee for Immigrants in America, of which Frank Trumbull is chairman and Geo. A. Cullen is secretary, with offices at 95 Madison avenue., New York, is an organization to act as a clearing house for all work on immigration and has started the *Immigrants in America Review.*

The board of directors of the National Paving Brick Manufacturers' Association, at their quarterly meeting held in Cleveland May 27, affirmed arrangements tentatively made for holding its annual meeting October 11-12 at Dayton, Ohio. During this week, namely October 12, 13, 14 and 15, will be held the annual meeting of the American Society of Municipal Improvements. These arrangements enable the members of the National Paving Brick Manufacturers' Association to attend the meeting of the American Society. The central location of Dayton gives the engineers of Ohio, Indiana and Kentucky and other states who have not heretofore been members of the American Society of Municipal Improvements an opportunity to attend that meeting and become enlisted in its roll of membership. There should be no absentee.

A large good roads and drainage congress was held in Houston, Tex., June 3 and 4, participated in by federal, state, city and county officials in 72 counties of Texas.

The Electric Power Club, engaged in the commercial standardization of electrical machinery and composed of the leading manufacturers of electrical machinery, at its annual meeting in Saegertown, Pa., May 13-15, elected E. R. Harding, of the Holtzer Cabot Electrical Co., president and C. H. Roth, of Roth Bros & Co., secretary.

The Blue Island, Ill., volunteer fire department will hold the annual tournament of the Illinois Volunteer Firemen's Association with a number of prizes offered and entertainment features. The local fire department is promoting the purchase of motor-driven apparatus for its use. A. C. Rohe is secretary and in charge of the preliminary work.

The American Electric Railway Association will hold its annual convention in the Exposition civic auditorium, San Francisco, Cal., Oct. 4-8.

The convention of the National Electric Light Association is held June 7-11 in San Francisco. This is the first of a dozen conventions of those interested in various electric uses to be held July 19, 21, September 16, October 4 and October 23, most of them in connection with the American Electric Railway Association October 4.

Conventions at the Panama-Pacific Exposition

Up to date 822 conventions have announced their meetings in connection with the Panama-Pacific Exposition, holding them in San Francisco, Oakland or other cities around San Francisco Bay. Of these conventions 57 are international and 525 are national, 68 are from the Pacific coast and 122 from California. August will have the largest number, 249, and December will have but 3.

Educational conventions will be 129 in number, fraternal 87 and down to 7 historical and literary. The conventions are grouped by subjects at as nearly the same time as possible. Thus in June there are 24 conventions on medicine and related topics. The educational period is August, 129 of them to be held, most of them in Oakland. The engineering and public improvement conventions, including road construction, are held largely in September and early October.

Personal Notes

Herbert M. Wilson, engineer in charge of the Pittsburg experiment station of the U. S. Bureau of Mines, has resigned to become the director of the Coal Mine Insurance Association, a new organization which is a combination of ten American and British insurance companies for the joint underwriting of coal mine accident insurance.

Poul Lindholm, engineer of highways, Copenhagen, Denmark, received the traveling fellowship of the American Scandinavian Foundation for 1915-16, and will spend the year in the graduate course in highway engineering at Columbia University, New York.

Gustave R. Tuska, M. Am. Soc. C. E., M. Am. Soc. M. E., consulting engineer, New York City, has been appointed lecturer in municipal waste disposal at Columbia University in the city of New York, and will deliver a course of lectures on this subject at the University during the coming year. Mr. Tuska has for some years been acting as consulting engineer to various garbage, refuse and waste disposal plants, both in this country and abroad.

C. E. Smith, recently assistant chief engineer of the Mis-

souri Pacific-Iron Mountain system, has opened an office as consulting engineer at 2075 Railway Exchange building, St. Louis, Mo. Mr. Smith is a member of the American Society of Civil Engineers, American Railway Engineering Association and American Society of Testing Materials.

William S. Moore has been appointed city engineer of Grand Rapids, Mich. Mr. Moore is a graduate of Purdue University, was city engineer of Mishawaka, Ind., from 1904 to 1910 and city engineer of South Bend, Ind., since 1910, so that he has had training and experience which fit him well for his new duties.

Robt. F. Hall, who succeeds J. P. Beck as publicity manager of the Universal Portland Cement Co., has spent the last six years in the sales department of that company. He is well known thruout the cement industry because of his activities in its association. His experience and education equip him well for the work he has now undertaken.

P. A. McCarthy & Sons, consulting, designing and supervising engineers at Lufkin, Tex., have opened a testing laboratory equipped for chemical and physical tests of structural materials and chemical tests and analysis of animal and vegetable matters generally.

Publications Received

John Wiley & Sons, New York, have published "The Panama Canal," by two naval officers, R. E. Bakenhus and H. S. Knapp, and Prof. E. R. Johnson, which gives in 257 pages a resume of the history and description of the canal, its design, construction, sanitation, cost and elements of success, its relation to the navy, its position in international law and its commercial importance, the first three parts of the work itself being by Mr. Bakenhus, the fourth and fifth on its relations by Capt. Knapp, and the sixth part by Professor Johnson. The price is $2.50.

Lefax, the monthly set of information cards, thoroly indexed for scientific filing, now comes in a wrapper with a table of the contents of the set on the outside. Price, $2.00 a year.

Conservation of Water by Storage, by George F. Swain, LL. D., Professor of Civil Engineering in Harvard University and past president of the American Society of Civil Engineers, is a book of 384 pages, containing a series of lectures delivered by the author in the Chester S. Lyman lecture series before the senior class of the Sheffield Scientific School of Yale University. It is published by the Yale University Press, New Haven, Conn., at $3.

The volume of proceedings of the second annual convention of the League of Minnesota Municipalities has been received. It can be obtained from G. A. Gesell, Municipal Reference Bureau, Minneapolis, for 25 cents. The next convention will be held in Virginia, Minn., October 20 and 21.

The edition of the Good Roads Year Book, 1915, issued by American Highway Association, Colorado Building, Washington, D. C., for $1.00, is fully up to the high standard of former issues and contains information worth many times the cost of the book to any one interested in better roads. Five copies will be sent for $4.00.

The Universal Portland Cement Company has compiled and published a booklet on "Local Improvements by Special Assessment in Illinois," containing a brief outline of procedure, references to court decisions and forms as they may be applied to a concrete paving improvement. Illinois special assessment laws are very complicated and such a guide should be of much assistance.

Hayes' "Public Utilities: Their Fair Present Value and Return" has just been published by D. Van Nostrand Company, New York, at $2.00 net.

Banking and Credit in Argentina, Brazil, Chile and Peru are discussed in a report just issued by the Federal Trade Commission, Washington, D. C., which will be of interest to those engaged in the development of foreign trade.

The New Winslow concrete computing slide-rule for computing strength and dimensions of reinforced concrete slabs, beams and girders is a very convenient combination rule with three slides with two scales each, and te stationary scales. Two extra scales are run in on parts of two of the sliding scales. The assumed standards are those of the Chicago building laws, but changes to suit other standards are easily computed. The price is $3.00, and it is sold by Henry W. Tomlinson, 64 East Van Buren street, Chicago, Ill. Its catch phrase is "Any beam problem solved in six seconds."

John W. Alvord, consulting engineer, Chicago, Ill., has a reprint of his article on "The Consulting Engineer in Water Works Practice," which he may send on request.

Data, one of the monthly collection of data cards for filing, is published at $2.00 a year by Engineering and Contracting, 608 South Dearborn street, Chicago, Ill.

Scientific Paper No. 234 of the United States Bureau of Standards is on the insulating properties of solid dielectnes and is by Harvey L. Curtis.

The National Conference on City Planning announces the issue of "Classified Selected List of References on City Planning," by Theodora Kimball, librarian of the School of Landscape Architecture at Harvard University. Boston, National Conference on City Planning, 1915. Forty-eight pages. Paper. Price, 50 cents. The list consists of about one thousand references on city planning, selected from many times that number, with a particular view to their professional value to those engaged in problems of city planning.

The United States Geological Survey has issued Bulletin No. 371 on a Reconnaissance of the Book Cliffs Coal Field in Colorado and Utah, and 541-D on Oil and Gas Near Green River, Grand County, Utah.

The report on the fire in the Edison Phonograph Works by the National Fire Protection Association and the National Board of Fire Underwriters can be obtained from either organization for 25 cents.

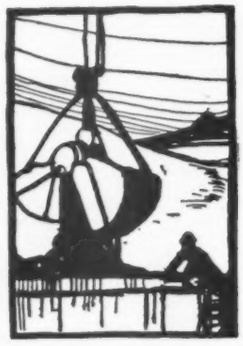
Bulletin 600 of the U. S. Geological Survey is a handsomely illustrated pamphlet of 54 pages and two folding maps on The Glacier National Park, which is a popular guide to its geology and scenery, by Morris F. Campbell. The character of the scenery is indicated by the photograph used on the front page of MUNICIPAL ENGINEERING for November, 1914.

The monthly bulletin of tests conducted by the City of New York upon samples taken from deliveries of materials and supplies was begun with results for October, 1914, and is a very valuable compilation of reliable data. November and December numbers have also been received.

The Directory of Cement, Gypsum and Lime Manufacturers for 1915, issued by *The Cement Era*, 538 South Clark street, Chicago, Ill., for $1, is received. It gives well classified information regarding cement manufacturing companies, their officers, sales agents, brands, capacity, etc., and similar information regarding the manufacture and sale of gypsum and lime.

The second volume of Metcalf and Eddy's "American Sewerage Practice," which is devoted to the construction of sewers, is issued by the McGraw-Hill Book Co., at $4. A third volume on sewage treatment is to follow.

An article on "The Nation's Business and the Nation's Government," by Felix Orman in *The Outlook* has been reprinted in pamphlet form by the Chamber of Commerce of the United States of America, and details the activities and the opportunities of that body. It can be obtained on application to Secretary Elliot H. Goodwin, Washington, D. C.



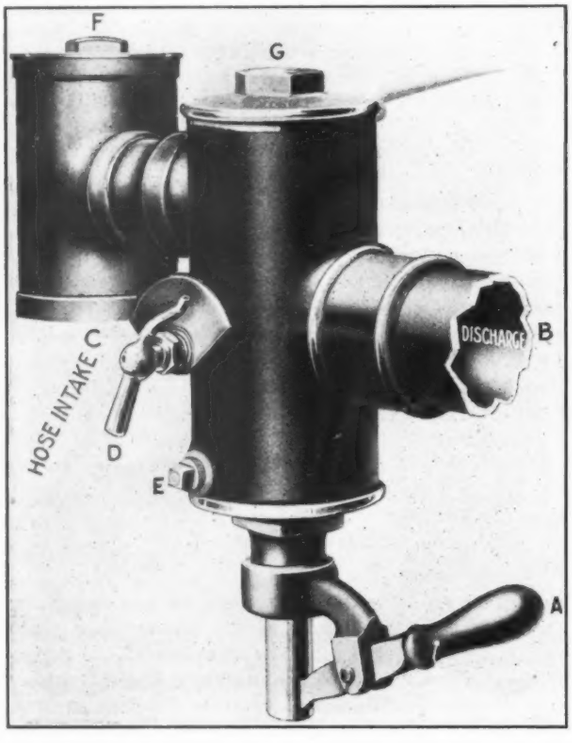
MACHINERY AND SUPPLIES

Badger Water Valve

The Badger water valve has been used on the Badger concrete mixer for two years and has given satisfaction wherever city pressure was the source of water supply. The valve for city pressure is too small to deliver the required quantity of water from tank pressure and a larger valve is supplied for tank pressure service. There are three sizes of valves. No. 1, 1¼-inch for city pressure supply only and on small mixers; No. 2, 2-inch for both city and tank pressure on medium size mixers; No. 3, 2½-inch for both city and tank pressure for the larger mixers.

A¾-inch to 1¼-inch hose will supply the water for the No. 1, 1½ to 2-inch for No. 2, and 2 to 2½-inch for the No. 3.

REGULATING VALVE *for supplying exact quantities of water to concrete mixer. The regulating lever D can be set for the quantity of water desired and a quick pressure of the discharge lever A furnishes this quantity to the batch of concrete.*



Nothing is more important than the accurate quantity of water in making good concrete. The regulating lever can be turned to any point on the dial to furnish the required quantity per batch and then one quick pressure of the discharge lever furnishes the exact quantity of water to each batch.

Experts and engineers in concrete say that 25 per cent. of water to the weight of cement makes weak concrete because it is too little water, than 30 per cent. makes weak concrete because it is too much water, that 27½ per cent. makes the strongest concrete, being one-third stronger than either the 25 per cent or 30 per cent. This shows the very great importance of getting the exact percentage of water delivered into each batch of ingredients. Twenty-six and one-half pounds of water to every bag of cement used is recommended, deducting 1 pound weight of water because there are only 96 pounds of cement in a bag. All ingredients should be mixed by at least two revolutions of the mixer drum before discharging the water into it.

Many engineers are specifying the use of the Badger water valve and the following of the above rules so as to insure good concrete. It is as essential with tank pressure as with city pressure. The Badger water valve is attached to the Badger mixer with all water pipe connections and the tank also, if required, at an additional cost, all connected up so that either city or tank pressure can be used.

The Badger water valve works on any rotating drum mixer, and they are furnished generally to manufacturers of concrete mixers and to contractors using any make of mixer.

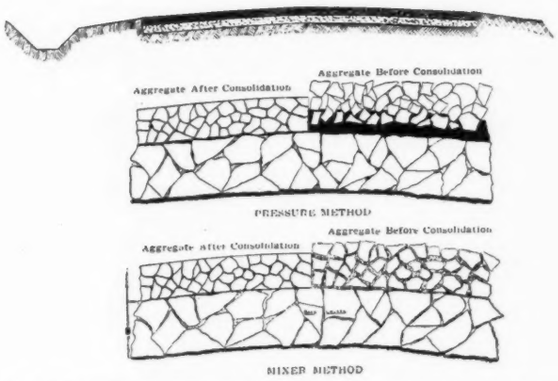
The Rocmac Road

A booklet recently received from the Rocmac Road Corporation of America of Cleveland, Ohio, describes the methods employed in the Rocmac process of building roads.

Rocmac is a chemical solution with a mineral base of silica. When mixed with limestone screenings containing 50 per cent. or more of calcium carbonate an insoluble silicate of lime is formed which, with the aid of carbonic acid in the atmosphere, becomes hard and tough.

It is claimed that the Rocmac matrix has often proved harder and tougher than the stone itself and that the life of the road becomes dependent upon the wearing qualities of the stone used. The specifications for building roads by the Rocmac process are similar to those employed for ordinary waterbound or asphaltic macadam. If the natural ground is not soft, spongy or otherwise unsuitable, it is stated that a 4½-inch Rocmac road makes a very economical and durable highway. The foundation may be of macadam or gravel or may be of concrete if desired.

Upon the prepared foundation a stiff mortar or matrix



DIAGRAMS SHOWING RESULTS *of methods of laying Rocmac road surface. The middle diagrams show what happens when the pressure method is used, which is said to secure the best results. The lower diagrams show the results when the mixer method is used. The upper diagram gives the entire design for the Rocmac road.*

composed of limestone screening mixed with Rocmac solution in the proportion of 36 gallons of Rocmac to one cubic yard of limestone, is spread to a uniform thickness of 1½ to 2⅛ inches.

The mixing of the matrix may be done by hand on a mixing board or by a concrete mixer. When spread, it is covered with a layer of crushed stone to a depth of 4 to 6 inches, loose. This stone is then thoroly rolled so as to puddle the matrix, causing it to flush up between the stone fragments. The rolling is continued until a grout forms over the entire surface.

Rocmac may also be laid by the mixing method if desired. It is stated, however, that the best results are obtainable from the pressure method above described. The effects of the two methods are shown by the accompanying drawings.

Rocmac is stated to be impervious to moisture. It is also stated that the first cost of Rocmac road is approximately the same as that of waterbound macadam.

The accompanying photograph shows a Rocmac road in Monroe county, near Rochester, N. Y. This road was laid in 1910 and there have been no repairs since that date. The surface is shown to be in excellent condition.

Buckeye Berea Curbing

A sandstone curbing of unusual durability is supplied by the Ohio Quarries Company, Cleveland, Ohio, and is known as the Buckeye Berea Curbing. Berea stone has been in use for curbing for more than a half century and its excellent qualities are evidenced by the satisfactory results it has produced in many cities.

The accompanying illustration shows the manner in which the curbing is split out of solid rock to the desired thickness and height. It is frequently shipped in this form to be dressed on the job. Some cities prefer to use the rough split curbing in order to provide employment for home labor, altho the machine dressed curbing is in greater demand.

Curbing for use on country highways requires very little dressing and this is ordinarily ordered rough split and is set flush with the pavement. The Ohio Quarries Company also supplies machine dressed Buckeye Berea curbing.

The following list shows some streets in which Berea sandstone curbing was placed many years ago. It is still serving its purpose, the number of years of service being given with each street:

Akron, Ohio—E. Market St., from Howard St., 2 miles east, 30; Main St., a portion in the downtown district, 27 years of service.

Ashland, Ohio—Orange and Center Sts. and Cleremont Ave., all 22 years.

Alliance, Ohio—Arch St., Main to Milner, 23; Seneca St., Main to Summitt, 18; Market St., Liberty to Mechanic, 18; Liberty St., Main to Summitt, 18 years.

Cleveland, Ohio—Carnegie Ave., E. 55th St. to E. 90th St., 40; E. 49th St., Cedar to Scovil Aves., 40 (this street was graded and curber in 1874; paved in 1899, using all the original curbing; no new); E. 51st St., Woodland to Julia, 23 (repaved in 1909 and the old curbing used the second time); E. 93d St., Euclid to Hough Aves., 23 (repaved in 1909 and the old curb used the second time); Woodland Ave., E. 55th to E. 79th Sts., 40; W. 32d St., Detroit to Franklin, 30 years (this street was graded and curbed in 1884, paving in 1905, using the original curbing; no new).

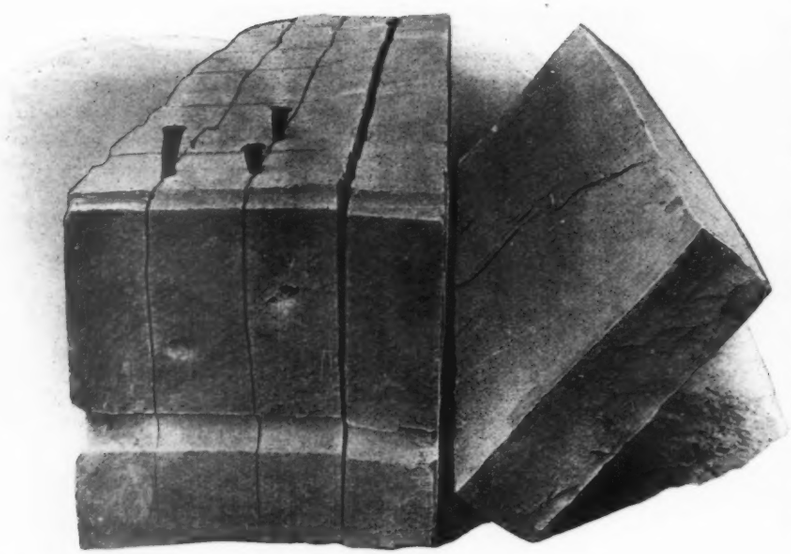
Chicago, Illinois—Sheridan Road, from Kenilworth Ave., north to city limits, 22 (most popular boulevard in Chicago; Morse Ave. This street paved twice and the original curbing used, 22; Austin Ave., 26 (this is a heavy traffic street and has been repaved three times and the original curb at this writing still in perfect condition); Chase Ave., 18 years.

Pekin, Illinois—There are several streets in the city curbed with Berea stone where the curb has been down 30 years.

Rogers Park (now part of Chicago)—Ridge Ave., 22 years.

Cambridge, Ohio—Wheeling Ave., 4th to 12th Sts., 15 years.

Columbus, Ohio—Atcheson, 20th to Graham, 26; Beck, High to Front, 26; Belle, Broad to Kimball, 26; Broad, Third to Parsons, 28; Bryden Road, Parsons to Miller, 26; Champion, Broad to Mt. Vernon, 26; Chestnut, High to Fourth, 28; Dennison Ave., Big Four to Goodale, 26; 15th, High to Indianola, 27; 5th, Neil to Perry, 26; 5th, Broad to Long, 27; 1st Ave., High to Neil, 26; 5th, Naghten to Town, 28; Franklin, Washington to Parsons, 26; Front, Town to Naghten, 27; Gay, 4th, to 5th, 27; Grant, Broad to Long, 27; Grove, Jefferson to St. Clair, 26; Hamilton, Long to Mt. Vernon, 27; High, 5th to 11th, 28; Hoffman, Broad to Oak, 28; Latta, Oak to Fair, 26; Lexington, Mt. Vernon to Felton, 26; Madison, Ohio to Hoff-



METHOD OF SPLITTING *Berea stone blocks to produce curb of specified thickness and depth. The surfaces of the sections of curb can be dressed at the quarry or on the job as desired.*

man, 27; Main, High to Sixth, 27; Miller, Broad to Main, 26; Monroe, Broad to Mt. Vernon, 27; Naghten, Mt. Vernon to La-Fayette, 26; 9th, Broad to Oak, 26; Ohio, Broad to Main, 26; Parsons, Main to Livingston, 26; 17th, Broad to Mt. Vernon, 27; 10th, High to Neil, 26 years.

Detroit, Michigan—Grosse Point Road, Detroit to Grosse Point (75,000) ft.), 10; Woodruff Ave. Past Fair Grounds, (20,000 ft.), 10; The Boulevard (100,000 ft.), 20 years.

Findlay, Ohio—Main St., Howard to Hind, 26 years.

Fostoria, Ohio—Main St., Cubertson to B. & O. R. R., 20 years.

Lakewood, Ohio—Grace Ave., Detroit to Madison Aves., 19; Clarence Ave., Detroit to Franklin Aves., 20 years.

Lorain Ohio—Broadway, Lake Erie to E. 21st St., 20 years (repaved in 1914 and practically all the old curb used, 14,000 feet of old curb and very little new).

Mansfield, Ohio—Park Ave., from Main to Sycamore, 21 years.

Marion, Indiana—4th St., Washington to Western, 25; Booth St., River to 14th, 24; Fourth St., from Washington to Western Ave., 25; Boots St., River to 14th St., 24; Third St., Washington to "E" St., 22 years.

Norwalk, Ohio—Whittlesey Ave., from Railroad to Main St., 27; North Main St., 26 years.

Syracuse, New York—East Water St., 15 years.

Toledo, Ohio—Emerald St., Morris to Logan, 25; Summer St., Garland to Ry., 25; Prescott St., Collingwood to Franklin, 25; Parkwood Ave., Bancroft to Virginia, 25; 21st St., Monroe to Madison, 25; Robinwood Ave., Bancroft to Delaware, 25; Warren St., Adams to Bancroft, 25 years.

Warren, Ohio—Mahoning Ave., High St. to city limits, 20; Main St., Erie R. R. north to High St., 20 years.

Wooster, Ohio—North Market St., from Public Sq. to Bowman St., 23; West Liberty St., from Square to Grant St., 22; South Market St., from Square to Spruce St., 22 years.

Three-Unit Asphalt Plant on Highway Construction

The operation of the three-unit asphalt plant of the Cummer type on highways surrounding Ashokan Reservoir, New York, is reported by W. B. Spencer, President, Continental Public Works Co., as follows:

We respectfully submit the following relative to actual operation of asphalt plants on highway work, contract No. 151, Board of Water Supply, City of New York:

The work, on which these plants were used, consisted of the laying of approximately 32 miles of bituminous macadam highways around the Ashokan reservoir. Four plants were engaged in this work, two of which were of the Cummer road type. The first road plant which we ordered proved so satisfactory, that we gave a repeat order shortly after the first one was put in operation.

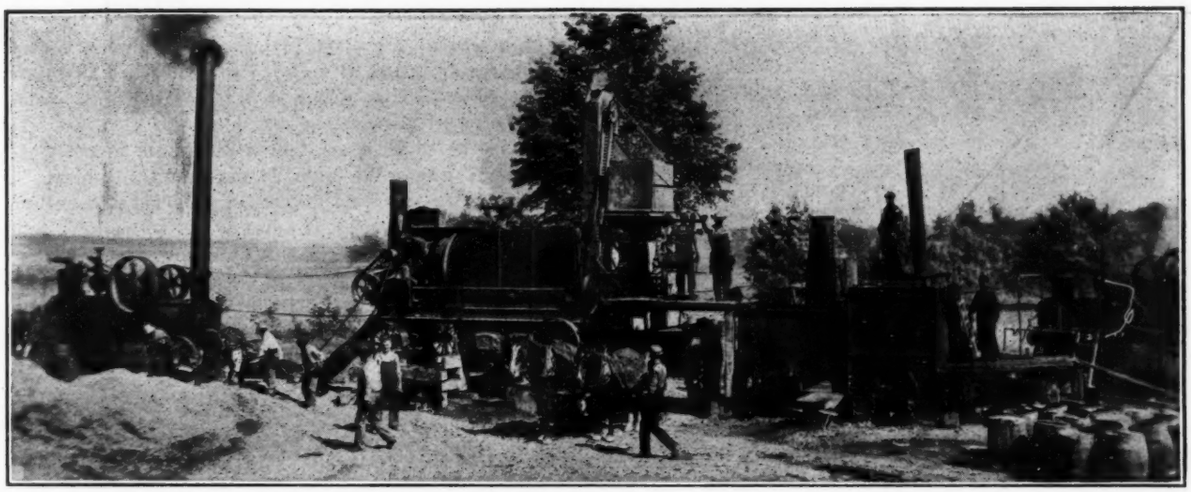
Before accepting the first plant a test was made at Cleveland. Sand containing 7 per cent. of moisture was introduced into the dryer, and an average temperature of 412 degrees Fahrenheit was obtained at the outlet of the dryer. During one hour's test ten and one-half tons of this sand was heated to the above temperature, the same being equivalent to about one thousand square yards of sand paving mixture per ten-hour day. The work at Ashokan, however, did not embrace the use of sand mixture, the specifications calling for crushed stone from 1½ inches in diameter down to ¼ inch. With this type of mixture the plant was able to show a largely increased capacity over the records made at the test in Cleveland.

The first unit consists of the Cummer type of sand drum, having a rated capacity of 8 tons per hour, also a 6-cu.-ft. batch-type mixer, with a capacity of 5 cubic feet, sand bin, measuring box, asphalt bucket together with conveying and weighing mechanism, hot and cold sand elevators, sand bin and sand measuring box. The gearing on this plant is cast steel thruout, the main bearings being brass bushed and adjustable. The sand bin has a capacity of 5½ tons heated material, and is equipped with a rotary screen arranged to permit the mixing of sheet asphalt topping, or binder, or asphaltic concrete without change. The sand measuring box is on a beam scale, and is so arranged that each ingredient can be weighed separately or combined. The asphalt bucket is on a double beam scale. The trucks for this unit are all steel thruout, the front wheels being 30 inches in diameter and 12 inches wide, and the rear wheels being 36 inches in diameter and 12 inches wide. The plant is driven by a belt from the engine, transmission on the plant being by a main shaft of 2 15/16 inches in diameter. The drum and mixer are connected directly with the main shaft.

The second unit is a 30-h. p. horizontal engine, made by the Erie Engine Works, of Erie, Pa., mounted on the boiler, the entire outfit being mounted on an all-steel truck. The stack folds back when being moved.

The third unit consists of a portable melting kettle, mounted on steel wheels and divided into two compartments each with a capacity of 5 tons. The illustration shows this kettle with hinged platforms for men to work upon in charging the kettle, and the fire box under the round-bottomed melting compartments.

As will be noted in the illustration herewith the plant consists of three parts, the first including the heating and mixing unit, the second the power unit, and the third, the asphalt



ROAD ASPHALT PAVING PLANT *of F. D. Cummer and Son, in three units for ease in moving. Power unit on the left, with engine mounted on boiler and folding stack can be set at any convenient distance from the sand dryer and mixer plant in the center. Asphalt melting kettle with two compartments is on the right and shows the folding platforms on which workmen stand.*

melting unit. These separate units, in our opinion, allow the plant to move from place to place much more easily than if they were all combined or even if there were two units in place of three. Another advantage is in the set up, for the three units can be placed very close together or the mixing plant and heating kettle can be set along side one another and the boiler and engine placed some distance away, using a long belt and a supporting pulley. This allows almost any kind of a set-up to be made. This plant can be loaded onto a flat car, the same as a roller. In shipping, the top of the bin containing the screen is removed and the upper 4 feet of the elevator (which is hinged) is laid over on its side.

The average time to move this type of plant, including kettles, steam lines, labor camps, storehouse, road materials, etc., and to set same up, ready to operate, the move being about 4 miles, is four days. We find this type of plant to be economical in operation and extremely portable, for the particular type of work on which it was operated.

How to Prevent the Reflection of Light and Heat From Concrete Pavements

Concrete sidewalks and other pavements that are laid in the natural cement color reflect the sunlight and heat so powerfully as to be very uncomfortable in hot weather and very injurious to the eyesight. This is being widely recognized by municipal authorities and every oculist and physician will heartily endorse the movement to make our streets more tolerable, because this constant reflection severely strains the eyes.

The accompanying illustration shows a condition that exists in some parts of the southwest where, on account of the wonderful clearness of the atmosphere the natural concrete pavement does it worst in this respect. It shows one of the principal streets of Oklahoma City, and although the halftone screen has modified the reflection, it still vividly demonstrates what the inhabitants of that and other cities are suffering without fully realizing the cause. For example, a motorman in Oklahoma City whose car ran mostly thru a new avenue which had recently been constructed and paved with concrete, said that he felt the strain upon his eyes but did not realize what caused it until it was pointed out to him and then he easily remembered that his eyes had not troubled him until he began to run on this concrete street.

The remedy is very simple, and in every way desirable.

In many parts of the country, especially in New England, this fault in concrete pavements was early recognized, and after many experiments the practice of adding a small amount of lampblack in the wearing surface mix was uniformly adopted. This gives them a cool, slate-gray tone, but it also overcomes the patchy, uneven results produced by the uncolored cement (which is sometimes yellowish, sometimes brownish and sometimes greenish gray), so that a very uniform bluish tone covers the whole surface and makes it much more finished and attractive.

Many cities and towns have adopted ordinances requiring the admixture of lampblack with the surface in all sidewalks and streets, and a great many others have adopted the practice without any ordinance requiring it, because it seemed the sensible thing to do. The cost is insignificant.

In Portland, Ore., the municipal specification is as follows: "To each barrel of sand used in mixing the wearing surface 1 pound of dry lampblack shall be added. The dry lampblack shall be mixed with the sand before mixing with the

CONCRETE SIDEWALK IN OKLAHOMA CITY, *showing the vivid reflection of light, which could be greatly modified by coloring the walk with lampblack.*

cement." Around Boston the standard specification reads, "From 1 to 2 pounds of Trimount Germantown lampblack shall be used per barrel of cement." The quantity depending upon the depth of shade required, and the natural color of the mix. This black is put up in 1 pound paper packages so that the quantities can be easily measured. It is sifted from the package into the mix or the sand and worked thoroly thru it in the mix. The coloring power of pure lampblack is so great that this quantity thoroly stains the mixture and it does not in any way weaken the bond.

Lampblack is very much stronger than other colors, such as reds and browns, and the latter are so weak that in order to get a good color with them it is necessary to use such large quantities that the cement bond is appreciably weakened. This same thing is true of adulterated lampblacks. Many so-called lampblacks are either heavily adulterated with charcoal, ground coal or other similar minerals or are composed entirely of such substitutes, so that their coloring power is much weaker than that of pure lampblack. They are sold at lower prices but are so weak that they are actually much more expensive to use than a pure lampblack. Lampblacks for this purpose should be free from grease so that they will mix readily.

A reform so simple as this and of such ultimate importance should not be delayed, and as it happens the sections that are the worst offenders are those in which the reform is most important, that is, in the south and southwest, where intense heat and strong sunlight prevail for long periods. The cost of the operation is so slight that contractors do not object to it as soon as they have tried it and observe the result, and it has another important advantage to them in that it enables them to get a uniform tone even tho their cement may sometimes vary in color.

An Edge Protector for Concrete Structures

The initial application of concrete to the construction of all kinds of structures has demonstrated the fact that it is absolutely unfit to resist any form of impact on its edges and while in the early stages of the art this had been remedied to some extent by rounding of corners, it was evident that a protecting member made part of the structure was needed.

Early experiments along these lines soon convinced engineers and constructors of this necessity and various protecting members were evolved giving more or less satisfaction.

The requirements of an edge protector are as follows:

The material from which it is fabricated must resist wear and deterioration from the action of the elements. Its section must be so designed that a maximum amount of metal shall occur where the wear is maximum. It must be sufficiently rigid in itself to distribute all shocks to the concrete in which it is embedded, it must be easily installed and have a method of anchoring which will make it part of the structure.

The member itself and the anchors should be of one piece thereby eliminating the possibility of omission or displacement of separate anchors.

Such an edge protector has been invented by F. Wm. Stocker, Hoboken, N. J., which follows scientific lines in its design. It is of T shape the web being 1 to 1 3/16 inches wide and ⅛ to 3/16 inches thick and the cross bar having a circular arc for its outside surface, being 1⅛ to 1⅜ inches wide over all and 5/16 to 7/16 inch thick at the center. Out of the flange are cut hook shaped strips, left attached at one end and bent back so that the hooks form anchors into the concrete.

The T shape of the stocker curb nosing bar makes it rigid and capable of distributing shocks over a considerable area. The anchors extending well into the body of the concrete, fasten the curbing in a positive and powerful manner.

The anchors are part of the bar thereby eliminating the labor of attaching them.

The bulk of the metal occurs where the wear is maximum thereby making it more permanent.

The entire section is galvanized after the bar has been punched and sheared thereby protecting every square inch of its surface from rusting. The section is designed for the protection of corners, curbs, steps, edges of loading platforms, in fact any concrete edge which is to be subjected to shocks of any kind.

The importance of protecting concrete curbs at street intersections is well understood, as all such locations are subjected to more wear from vehicular traffic. The bar is furnished bent to required radius for use on curved corners in such places.

The interlocking hooks in the concrete prevent distortion, and the form of the head insures sufficient wearing surface to meet existing conditions.

The usual unsightly appearance of concrete steps with the edges broken is sufficient proof of the necessity of an edge protector; for this purpose the curb-nosing is ideal.

It makes the steps everlasting, improves their appearance and by defining a true edge saves considerable labor in the execution of a contract.

Expansion and contraction are controlled by the insertion of this bar to a considerable extent.

Square or rectangular concrete columns and posts in structures where extensive traffic and trucking is in progress are subjected to blows from trucks, boxes, merchandise, etc., and injured materially. In factories, warehouses and buildings of this class, it is essential that the column edges be protected to insure durability and neatness in appearance. Chipped corners are unsightly and weaken the column as well as open the way for disintegration of the concrete in places where they are exposed to the elements.

The angle which is a modification of the Stocker curb nosing, is superior in this respect to the regular curb-nosing in so far as it gives a larger area with no increase of weight in metal. The side prongs permit the usual installation of reinforcing bars in the corners of the columns which could not be accomplished were the curb-nosing used in its stead.

The installation is most simple as the outer shape of the angle fits the form absolutely and does away with the danger of the bar turning while concrete is deposited.

The angle can be fastened to the forms before they are set in place by simply nailing, or by means of hooks at the top and bottom.

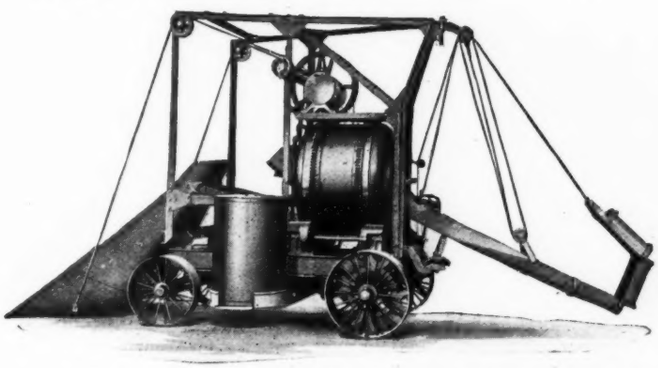
It consists of a 3/16 or ¾-inch plate bent to cover two sides of a column 1⅝ inches on each side of the corner, with the hook shaped strips cut out of one side and bent back into the column, thus preventing interference with corner reinforcing bars in the protected column.

Power-driven Distributing Spout for Concrete Mixer

An unusual feature of the Koehring mixer line, is a platform-controlled, power-driven distributing spout 20 feet long, which swings on an angle of 180 degrees.

The purpose of this spout is to do away with the labor of pushing spout into position by hand, and to bring its control into the hands of the mixer operator, who also controls the loading skip, water tank, etc.

Control levers for the new Koehring spout are all within reach of this operator, who lengthens and shortens, and swings the spout to any position.



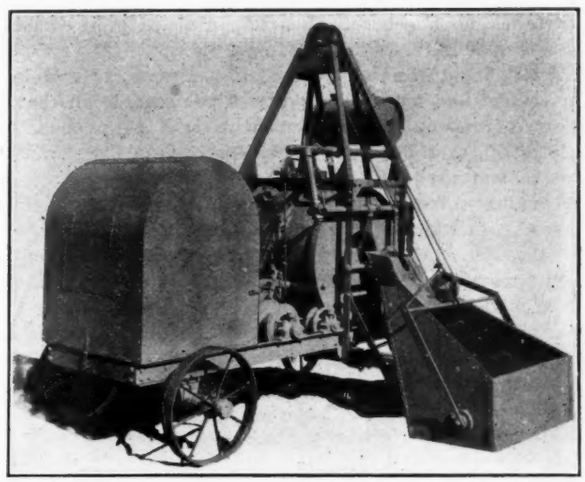
Besides the platform-control, the new Koehring spout has two especially important automatic actions, both of which overcome objections to the spout methods. When the spout is shortened, and the unused sections are elevated out of the way, the point of discharge of sections in use automatically lowers. This maintains the point of delivery at a low uniform distance from the ground, regardless of how few sections are in use, and prevents the separation of aggregates occasioned by a high drop. The other feature is an automatic lock which prevents swinging of spout by gravity, when mixer is not standing on a perfect level.

The advantages of the new spout are: The elimination of the extra man to swing the spout, other than the regular mixer operator, and its more positive, faster action, which is practically equal to the boom and bucket method.

The Master Concrete Mixer

There are about a dozen features of the "Master" concrete mixer which are emphasized by the manufacturers, The Chalmers Machinery Co., Toledo, O., and make it worthy of the careful study of every contractor and engineer in charge of work done by day labor.

One point is the steeel construction, there being only three castings of material importance in the machines, the two ends of the drum and the sprocket. This saves some thousand pounds in weight and with the larger wheels and short wheel base makes the mixer easily portable by hitching it to the back of a wagon.



THE MASTER CONCRETE MIXER. *Note form of the side-loader, automatic water tank and enclosed engine.*

Chain drive, surplus power, trunnion rollers, positive lock washers, double-grip clutch with dust cover, pillow-block bearings, practical features which will be fully appreciated by the contractor, who must operate the machine and keep it in repair.

The materials are loaded into the mixer by a side-loader which will not choke at the mouth or spill over the side when discharging. A jack brace can be hooked on the hoisting frame to support the hopper while the machine is being moved. A single handle controls all the operations of the hoist.

The discharge is quite as easy to operate. Pressing the grip on a handle releases the chute which can be tipped forward to discharge any amoont of concrete desired, from a pailful up. The discharge is high enough to give the wheelbarrow plenty of room.

The re-mixture of materials in the drum forty times a minute insures thoro mixture.

The water-tank is automatic, discharging the exact amount required for a batch, an adjustable float governing the discharge. The closing of valve when tank is filled is also automatic.

Oil-Mixed Concrete for Damp Proofing

After extensive laboratory and service tests the Department of Agriculture has secured results which appear to establish definitely the value of oil-mixed concrete for dampproof construction. Detailed results of these tests, which were carried out in connection with the work of the office of public roads, are contained in the new bulletin, No. 230, of the department, entitled "Oil-Mixed Portland Cement Concrete." Briefly summarized, the conclusions to be drawn from them are that the mixture of certain mineral oils in small proportions, not to exceed 10 per cent. of cement used, does not lessen the tensile strength of mortar; that the decrease in the compressive strength of mortar and concrete is not serious; that concrete mixed with oil takes much longer to set hard, perhaps twice as long, but that the increase in strength is nearly as rapid in the oil-mixed material as in the plain concrete. The use of oil does not make the concrete impervious to heavy water pressure, but it does make it practically non-absorbent under low heads.

The value of oil-mixed concrete is said to be particularly

great in the construction of basement floors and walls, watering troughs, cisterns, barns, silos and in all parts of concrete structures that are to be made damp-proof.

The oil should in no case exceed 10 per cent. of the weight of the cement and for the most part 5 per cent. is all that is necessary. Since a bag of cement weighs 94 pounds, 4.7 pounds of oil, or about 2½ quarts, should be added for each bag of cement used in the mixture. The sand and cement should be first mixed with the proper amount of water into a stiff mortar, to which is added the correct amount of oil, and the whole mass again thoroughly mixed until all traces of oil have disappeared. Particular care should be taken to insure that the oil is thoroly incoroporated in the mixture and the time of mixing should be practically double that when the oil is not used. For this reason a continuous mixer should not be used in oil-cement-concrete work, as it is difficult with this type of machine to increase the time of mixing sufficiently.

The kind of oil is also important and the following technical specifications are suggested in the bulletin in order to prevent the use of certain oils which might tend to impair the strength of the mortar or the concrete.

(1) The oil shall be a fluid product and shall contain no admixture of fatty or vegetable oils.

(2) It shall have a specific gravity not greater than 0.945 at a temperature of 25 deg.

(3) It shall show a flash point of not less than 150 deg. C. by the closed-cup method.

(4) When 240 cc. of the oil is heated in an Engler viscosimeter to 50 deg. C., and maintained at that temperature for at least three minutes, the first 100 cc. which flows out shall show a specific viscosity of not less than 15 nor more than 30.

(5) When 1 part of the oil is shaken up with 2 parts of hundredth normal caustic soda, there shall be no emulsification, and upon allowing the mixture to remain quiet the two components shall rapidly separate in distinct layers.

For practical use the addition of oil will be found particularly useful in the construction of basement floors and walls. Many of these now in existence are continually damp and such a condition may be remedied by the application of an oil-mixed mortar coat to the old surface. A mortar composed of one part of cement and two parts sand and containing 5 per cent. of oil should be sufficiently non-absorbent for this purpose.

Watering troughs and cisterns made of oil-mixed concrete should also prove of considerable practical value in the conservation of water. In the construction of barns, where oil-mixed concrete is used, the interior will be noticeably drier than when ordinary concrete is used. Owing to their durability, cleanliness and resistance to fire, concrete barns are becoming more and more popular, but they suffer from the disadvantage that during a long beating rain the side walls are inclined to absorb much moisture, which ultimately penetrates into the interior. The addition of oil to the extent of 5 per cent. of the weight of cement in the concrete used in the side walls obviates this objection. Barn floors can also be constructed in the same way with advantage. A damp-proof floor is warmer because of the lack of evaporation from its surface, and it is also more sanitary than an ordinary concrete floor because of its non-absorbent character.

There are, of course, any number of other types of buildings and structures of all sorts in which oil-mixed concrete may be used advantageously, or, if this is not necessary, a coat of oil-mixed mortar may be applied effectively.

Attention is called, however, to the fact that extreme care in proportioning, mixing and placing the concrete is absolutely necessary if the addition of any water-proofing agent is to be of value. The process of mixing oil with concrete has been covered by a public patent so that any one is at liberty to use it.

The Mietz and Weiss Oil Engine is Popular

Recent installations of Mietz and Weiss oil engines include the Grinden Art Metal Co., Brooklyn, N. Y., two 50-h.p. engines; the Town of Schleswig, Iowa, one 50-h.p. and one 75-h.p. engine to operate alternator in connection with municipal lighting plant; Belle Ellen Stock Farms, of Branchville, N. J., one 25-h.p. engine; I. H. Pitts & Son, Waverly Hall, Ga., one 30-h.p. engine; Marcus Mason & Co., So. Framingham, Mass., one 25-h.p. engine; Chas. N. Taylor, Salisbury, Mass., one 25-h.p. engine; Geo. Buckley, Menlo, Iowa, one 40-h.p. engine; the U. S. Government for Light Ships No. 101 and No. 102, two 200-h.p. M. & W. direct reversible marine type oil engines, and four 50-h.p. M. & W. oil engine air compressor outfits.

New Type of Pressed Steel Building Construction

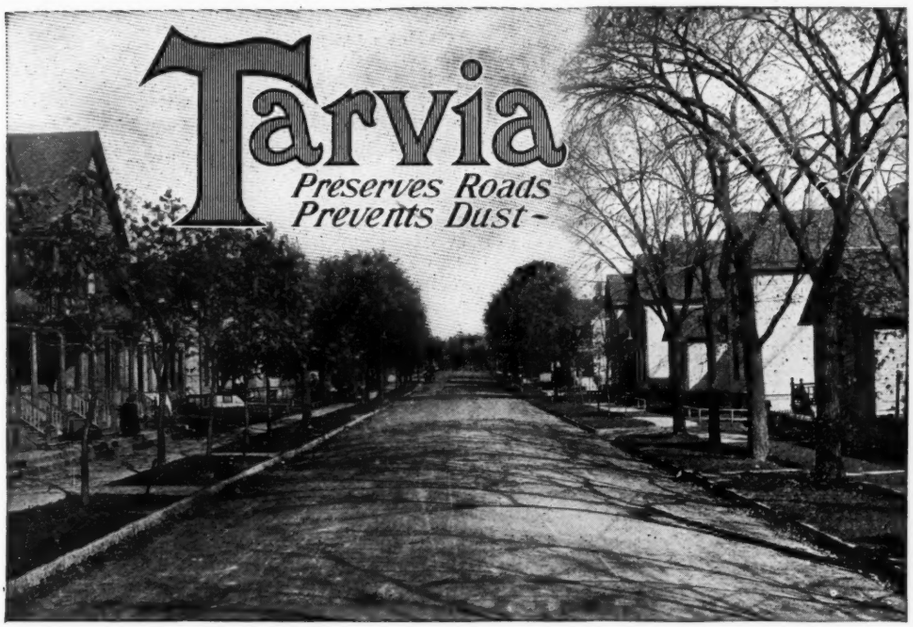
The Trussed Concrete Steel Co., Youngstown, has just issued a pamphlet illustrating a new type of construction, consisting of pressed steel frame work with metal lath, stucco, concrete and plaster. The Kahn pressed steel construction has a wide field of applications, its two principal fields being, first, in connection with floors of stores, apartment houses, and small buildings generally; and second, in multiple or group houses for mines and industrial plants.

In floors the Kahn pressed steel beams eliminate inflammable wood joists giving a permanent construction of great strength. Upon these beams, which are placed 23½ inches on centers is laid ⅜-inch Hy-Rib lath and concrete is applied. Where wood floor is desired, wood sleepers are attached to the pressed steel beams by nailing between the channels. For the ceiling under the beams the ⅜-inch Hy-Rib lath is readily attached by means of prongs on the underside of the beams. All of the pressed steel members are completely fabricated in the shops, eliminating all labor on the job. A floor of this nature costs very little more than wood joists and lath and is constructed more rapidly and is much more economical owing to its fireproofness and permanence.

In multiple houses Kahn pressed steel construction furnishes a permanent house which can be erected at minimum cost. This construction is a result of long years of study and experiment. All wood is entirely eliminated in the structural part of the building. In spite of this the construction can be erected more rapidly and easier than even the simplest wood construction. For instance, the house shown on the front cover of the pamphlet was erected in a few hours by workmen entirely unfamiliar with building construction.

This construction has extreme simplicity. The pressed steel members are completely fabricated in the factory and provided with all connections, punching, etc., that may be necessary. No labor whatever is required on them at the building site. The steel members are placed 23½ inches apart, as compared with 16 inches for wood construction. To join them together the simplest connection imaginable has been devised, one that entirely eliminates all bolting, punching or riveting, much simpler and requiring less time than to join wood work. The Hy-Rib lath construction is merely hung over the prongs on the steel members, and the prongs are bent down by the blow of the hammer. After this all that is necessary is to plaster the inside and outside.

Kahn pressed steel construction has all the advantages of fireproofness, permanence and sanitation. There is nothing about it that can burn or rot out. It is germ proof and sanitary in every way. A house can be designed so that you can move out the furniture and wash it out with a house. These houses are quickly erected by an ordinary mechanic, requiring less than half the time required in frame houses. The



Third Ave., Milwaukee, Wis.
Treated with "Tarvia B".

Milwaukee likes Tarvia—

Scores and scores of towns use Tarvia year after year to maintain their macadam roads and suppress the dust nuisance.

The experience of Milwaukee is typical and we will let Mr. Charles O. Davis, of the Department of Public Works, speak for himself:

"During 1913 the City of Milwaukee purchased 40,000 odd gallons of your 'Tarvia B' product. This year (1914) we used 150,000 gallons. These figures show what we think of 'Tarvia B'.
"We have applied this material on tar penetration streets which had begun to ravel, and found that with a very good covering of this material the raveling was stopped, and gave to the road a nice, smooth surface.

"Our experience also on waterbound macadam streets is satisfactory and the streets show up fine. One application sets up the surface, keeping out all water, with the result that the road is kept in good condition as well as it eliminates the dust nuisance.

"In closing we heartily recommend 'Tarvia B' for treatment where good results are required."

Tarvia is so low in price and *adds so much to the life of the roadway* that it has become a necessary feature of an economical road program.

Booklets telling all about the treatment free on request. Address nearest office.

Special Service Department

This company has a corps of trained engineers and chemists who have given years of study to modern road problems.
The advice of these men may be had for the asking by anyone interested.

If you will write to the nearest office regarding road problems and conditions in your vicinity, the matter will have prompt attention.

BARRETT MANUFACTURING COMPANY

New York Chicago Philadelphia Boston St. Louis Cleveland Cincinnati
Pittsburgh Detroit Birmingham Kansas City Minneapolis Salt Lake City Seattle

THE PATERSON MFG. CO., Limited: Montreal Toronto Winnipeg Vancouver
St. John, N. B. Halifax, N. S. Sydney, N. S.

cost of construction compares very favorably with wood houses, being much less expensive than any other type of permanent construction.

A Contractor's Pump

Water-bound macadam roads, concrete roads, in fact, all roads, when newly made, require a great deal of water in their construction.

In country road building the water supply for both mixer and watering down the road, has been a problem to the contractor, and with the large building of roads, a portable pump to supply water fills this demand.

The C. H. & E. power driven piston force pump has done good service on roads being built thruout the country, pumping to a distance as great as 2½ to 3 miles.

It is an outfit also suitable for small pumping stations, railway supply systems, small irrigation plants, country homes, etc.

The pump gears are machine cut, the pinion and spur gear which drives the pump plunger from both sides of the pump, insures perfect alignment. The bearings are large and liberally provided with oil cups, and the entire construction of pump is built to withstand the great strain it is put to under constant service.

Both C. H. & E. engine and pump are mounted on a rigid iron base, which is bolted to the skid or steel truck as ordered.

A photograph of the pump will be found on page 330, as an illustration of machinery used in building a Michigan concrete road.

Trade Notes

The Wisconsin Granite Co. have moved their offices to 1501-3 Lumber Exchange, Madison and LaSalle streets, Chicago, Ill. They have added to their number of plants and quarries to care for the needs of the trade.

The Cement Products Exhibition Co. has elected B. F. Affleck president, and Robert F. Hall as secretary, both of Chicago, Ill.

The Raymond Concrete Pile Co. has been awarded contracts for concrete piling for the foundation of a new stack for the Quindaro Pumping Station, Kansas City, Kan.; for concrete piles for the foundation of the Connally Building, Whitehall and Alabama streets, Atlanta, Ga.; for placing concrete piles for the foundation of a warehouse for Mr. Louis Miller, Baltimore, Md.; for the design and construction of the foundations, tunnels, etc., for the new Ordnance Department buildings of the Crucible Steel Co. of America at their Atha plant, Harrison, N. J.; for placing concrete piles in the foundation for the Church of St. Gregory, Brooklyn avenue and St. Johns Place, Brooklyn, N. Y.; for the concrete piles in foundations for the new Syria Temple, Pittsburgh, Pa.; for concrete piles in foundation for the new reinforced concrete warehouse for the P. H. Butler Co., at Seventeenth and Pike streets, Pittsburgh, Pa.; for concrete piling for the foundation of a warehouse for the Eagle Pencil Co.; for concrete piles for foundations at Christy Park Works, McKeesport, Pa., of the National Tube Co.

MacArthur Concrete Pile & Foundation Company, 11 Pine street, New York, has been awarded contracts for pedestal concrete piles at the Eagle Works of the Standard Oil Company, Claremont, N. J.; for foundation of the new Boston National League Baseball Co. grandstand; for foundations of the new fountain in Grant Park, Chicago; for foundation of addition to Malleable Iron Fittings Co., Branford, Conn.; for the pile foundation of the Y. W. C. A. building, San Jose, Cal.

The Port Huron Engine & Thresher Company have sold their plant No. 1, at Port Huron, Mich., to the Grand Trunk Railway Company for car building shops, and will remove to the property known as their plants Nos. 2 and 3, at South Park, a mile south of the present location. Their new quarters are on twenty-seven acres of land, giving ample room for expansion. The buildings are modern in plan and construction, and additions have been begun to give more shop room.

The Universal Portland Cement Co. makes the following announcements: R. F. Atkins, formerly assistant credit manager at Chicago, has been appointed eastern credit manager at Pittsburgh, vice L. S. Fuqua, deceased. Ray S. Huey, formerly assistant general superintendent, Buffington plant, Buffington, Ind., has been appointed superintendent of the Duluth plant, Duluth, Minn. Fred Robinson has been appointed assistant superintendent of that plant. C. O. Soderquist, formerly superintendent of Mill No. 6, at Buffington plant, has been appointed assistant general superintendent, Buffington plant. J. H. Kempster, formerly chief chemist, Buffington plant, is now superintendent of Mills 3 and 4 of the Buffington plant. M. S. Humphreys, formerly chief draftsman, has been appointed superintendent Mill No. 6 at Buffington, Ind.

The Uniform Asphalt Distributor Co., Meridian, Miss., held a demonstration, on June 31, of their machine for distributing asphalt in road construction or surface treatment, at Meridian.

Little Falls, N. Y., is following the other cities in the Mohawk valley, using bitulithic by laying it with concrete curbing on Garden street and on Monroe street.

Bridgeport, Conn., will lay $200,000 worth of Warrenite on its streets this year, at a cost of $1.20 a square yard, under five-year guaranty.

Trade Publications

Bulletin No. 58 of the Hauck Manufacturing Company, Brooklyn, N. Y., shows kerosene burners, heaters and torches for contractors, water works, highways, gas and sewerage departments, for lead melting, stone breaking, ground thawing, night and tunnel lighting, asphalt surface heating, asphalt melting, etc.

"Montezuma Asphalt" is the subject of a handsomely illustrated booklet with that title, which is issued by the Warner-Quinlan Asphalt Company, New York and Syracuse, N. Y.

The Kerr Turbine Company, Wellsville, N. Y., have just issued bulletin No. 52, describing and illustrating "Economy" steam-turbine-driven pumps for water supply, boiler feeding, fire service, circulating condenser water, circulating water in heating systems, draining mines, etc. 24 pages, 6x9. A copy will be mailed on application.

Warren Brothers Company have published in pamphlet form the decision of the New York Supreme Court in the Rochester case, to the effect that patented pavements can be specified and that bitulithic is a kind of pavement and not merely a brand of material; also the judgment of the Supreme Court of Alberta, Canada, sustaining the validity of the Canadian basic bitulithic patent.

The Koehring Machine Company, Milwaukee, Wis., issue a striking circular regarding their mixers, with the title, "Care Right Now Means Profits Then."

Century creosoted wood blocks for interior use are shown in Booklet B, issued by the Pittsburg, Ohio and Michigan Wood Preserving Companies, whose general offices are in the Commonwealth building, Pittsburg, Pa.

The Cement Tile Machinery Co., of Waterloo, Iowa, has a new catalog of S. & S. concrete machinery devoted to Winner and Money Maker brands of concrete mixers.

The calcium chloride supplied by the Semet-Solvay Co., Syracuse, N. Y., is described in a booklet on Solvay granu-

Protected with PYROBAR

Y. M. C. A. Building, Brockton, Mass. Shattuck & Hussey, Chicago, Architects.

Maximum efficiency and economy---used in countless public buildings of the first class. Scientific tests---official approval such as that of the National Board of Fire Underwriters---these are some of the reasons for the swiftly growing popularity of

PYROBAR GYPSUM TILE

ECONOMY

In labor and many ways, and particularly in dead-load saving. Pyrobar is 40% lighter than Terra Cotta Tile.

SOUND PROOFING

Pyrobar has been proved (by researches of the Lewis Institute, Chicago) 60% more sound proof than Terra Cotta Tile.

Booklet on Request.

UNITED STATES GYPSUM COMPANY

"World's Largest Producers of Gypsum Products"

205 West Monroe Street CHICAGO

New York Cleveland Kansas City Minneapolis San Francisco

lated calcium chloride, published by the company, with figures of cost and illustrations of the method of applying it with a spreader to city streets, state highways, park and cemetery driveways, tennis courts, play grounds, cricket grounds, etc.

S. E. Parker, Chicago, Ill., issues circulars and catalog of reversible friction hoists and other machinery for contractors' use.

Albert E. Langfahl, Monticello, Utah, is representing the Baker Mfg. Co., of Springfield, Ill., making road graders, street sweepers and other such machinery and supplies and also represents the caterpillar tractor.

The Russell Grader Mfg. Co., Minneapolis, Minn., have issued a new catalog of their road graders, wheel and drag scrapers, corrugated iron culverts, plows, road drags, etc.

The Kinney Mfg. Co., Boston, Mass., have issued an edition of Bulletin No. 1 on Kinney rotating plunger pumps, which include railroading asphalt or other bituminous materials from tank cars, agitating asphalt cement in paving plants for heating, and the like; also catalog of machinery for handling bituminous materials on highway work.

The Baker Mfg. Co., Chicago office 337 W. Madison St., send a circular on the Witten one-horse and hand automatic dump carts with illustrations of its many uses in street cleaning and in handling gravel, sand, farm products, packages for shipment, etc.

A new circular of Studebaker, South Bend, Ind., fully describes their uniform-pressure power street flusher and its use in cleaning streets.

The Clip-Bar Mfg. Co., Philadelphia, Pa., sends a circular on their method of protecting curb corners.

The new Kissel-Kar booklet is a handsome example of work by the offset process and is devoted to the Kissel sixes.

The Ohio Brass Co., Mansfield, Ohio, issue a periodical bulletin devoted to the many electric and railway appliances which they manufacture.

The 1915 presentation of the Ashley system of sewage disposal for single houses and institutions and small groups of houses marks the tenth year since the system was first presented and the material progress which the system has made. It will be sent on request by the Ashley Sewage Disposal Company, Box 24, Morgan Park Sta., Chicago, Ill.

The Universal Concrete Bar Co., 167 W. Washington St., Chicago, Ill., will send on request a copy of a circular descriptive of their corner bar for protecting corners of sidewalks, curbs, etc., and their joint protector for pavements.

The Quantity Survey Co., 30 E. 42d St., New York, have issued a booklet on their application of the method of supplying guaranteed statements of quantities required in bidding on a contract which has long been in use in some form in European countries.

In air meter bulletin A5 the New Jersey Meter Co., illustrate and describe their Tool-om-eter, which is an improved type of compressed air meter.

The Cement Gun Co. has issued bulletin No. 40 on protection of structural steel in a ferry terminal by their method.

Contracts have been awarded to the Raymond Concrete Pile Co. for concrete piles in the foundation of apartment building for Nels Gross, Chicago, Ill.; by the Maryland Steel Co., Sparrows Point, Md., for building marine railway at their plant; by the McLennan Construction Co., Chicago, for concrete piles for the Hardy apartment; and for concrete piling for the foundation of the Union National Bank Bldg., Cleveland, Ohio.

The Turbine Sewer Renovating Machine is very successful in cleaning sewers, as shown by a circular illustrating and describing work done by it in Portland, Ore., and Oshkosh, Wis., which can be obtained on application to the company at Milwaukee, Wis.

The Link-Belt Co., Chicago, Ill., sends two new circulars descriptive of the Wendell centrifugal coal drier and the Link-Belt electric hoist.

Ransome concrete forms are shown in a recent booklet of the Ransome International Conduit Co., New York.

The rapid loader for use in loading wagons from gondola cars and the rapid sand and gravel washer are the subjects of two circulars issued by the Bonney Supply Co., Rochester, N. Y. Both are great time and money savers for the contractor and the dealer in materials of construction.

The new catalog of the Metropolitan Paving Brick Co., of Canton, Ohio, is deserving of hearty commendation. It is the most attractive catalog of its kind that has been received, at the same time that it gives the advantages of the various processes thru which bricks pass in the course of manufacture and a full idea of the methods of making and burning vitrified paving blocks and other forms of brick.

Pioneer expansion joint compound and asphalt filler are special products of the Pioneer Asphalt Co., Lawrenceville, Ill., which are described in a booklet issued by the company, which illustrates their use.

D. Van Nostrand Co. have issued their 1915 catalog of Van Nostrand books, technical, industrial, engineering and scientific, and will send it on request of intending purchasers.

"Permanent Paving" is the title of a handsome booklet issued by the Granite Paving Block Manufacturers' Association of the United States, which shows the durability of granite pavements and the advantages of improved granite pavements with dressed blocks and grouted joints. It will be sent on request by Zenas W. Carter, field secretary, 54 Devonshire street, Boston, Mass.

The Grand mortar mixer of the Hall-Holmes Mfg. Co., Jackson, Mich., is illustrated in a recent circular, together with a concrete mixer and a sand sifter.

The E. D. Coddington Mfg. Co., North Milwaukee, Wis., issue a pamphlet descriptive of E-Cod fabric for concrete encased buildings.

The Maney four-wheel scraper, self-loading and self-dumping, is fully shown in a booklet issued by the Baker Mfg. Co., Springfield, Ill.

The Orangeburg Conduit is the subject of a comprehensive descriptive catalog and price list of 84 pages, fully illustrated with photographs and tables, which is issued by the Fibre Conduit Co., Orangeburg, N. Y.

Studebaker carriages are shown in Catalog 1002 of the Studebaker Corporation, South Bend, Ind.

The American Playgrounds Device Co., formerly The American Playground Device & Swing Co., of Terre Haute, Ind., have outgrown their old quarters, and have secured a new site and buildings at Anderson, Ind. They have also reorganized, increased their capital stock, and are now manufacturing a very complete line of park and playground equipment and porch and lawn furniture at the latter place.

Acme non-slip wood paving block are explained in a circular of the Philadelphia Wood Paving Block Co., Philadelphia, Pa.

Y concrete sockets for support of pipes, motors or any other apparatus, are shown in a circular of the Concrete Socket Mfg. Co., Philadelphia, Pa.

The Hotchkiss Lock Metal Form Co., Binghamton, N. Y., furnish gang forms for block construction, also post forms, silo, cistern and catch-basin forms.

Kerr Turbine Co., Wellsville, N. Y., are distributing Bulletin No. 53, on "Economy" exhaust steam turbines, which describes and illustrates typical installations and explains the conditions under which exhaust turbines can be made to produce large increase in power output practically without other expense than the cost of the turbine installation. A copy of this bulletin will be mailed upon request.